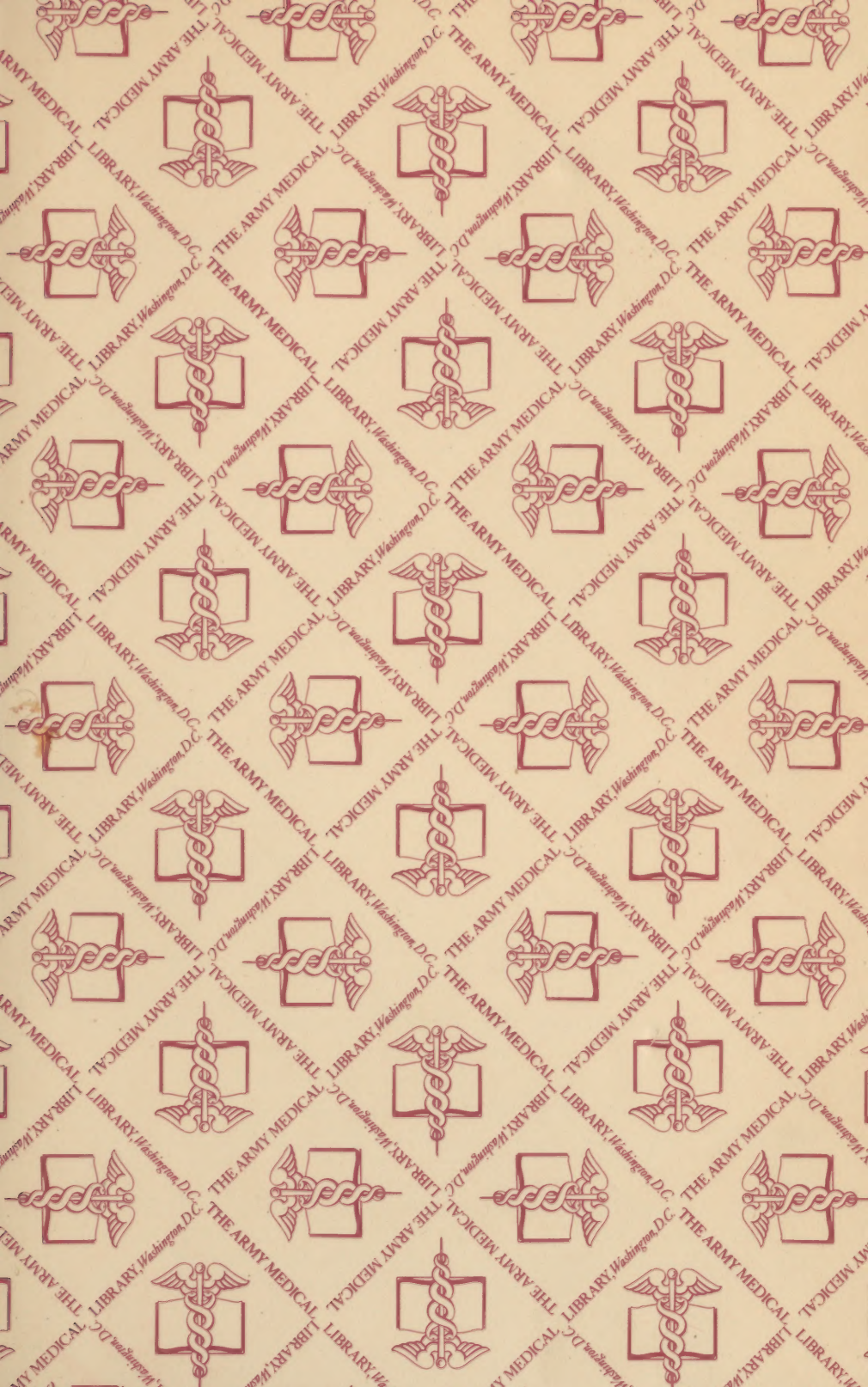


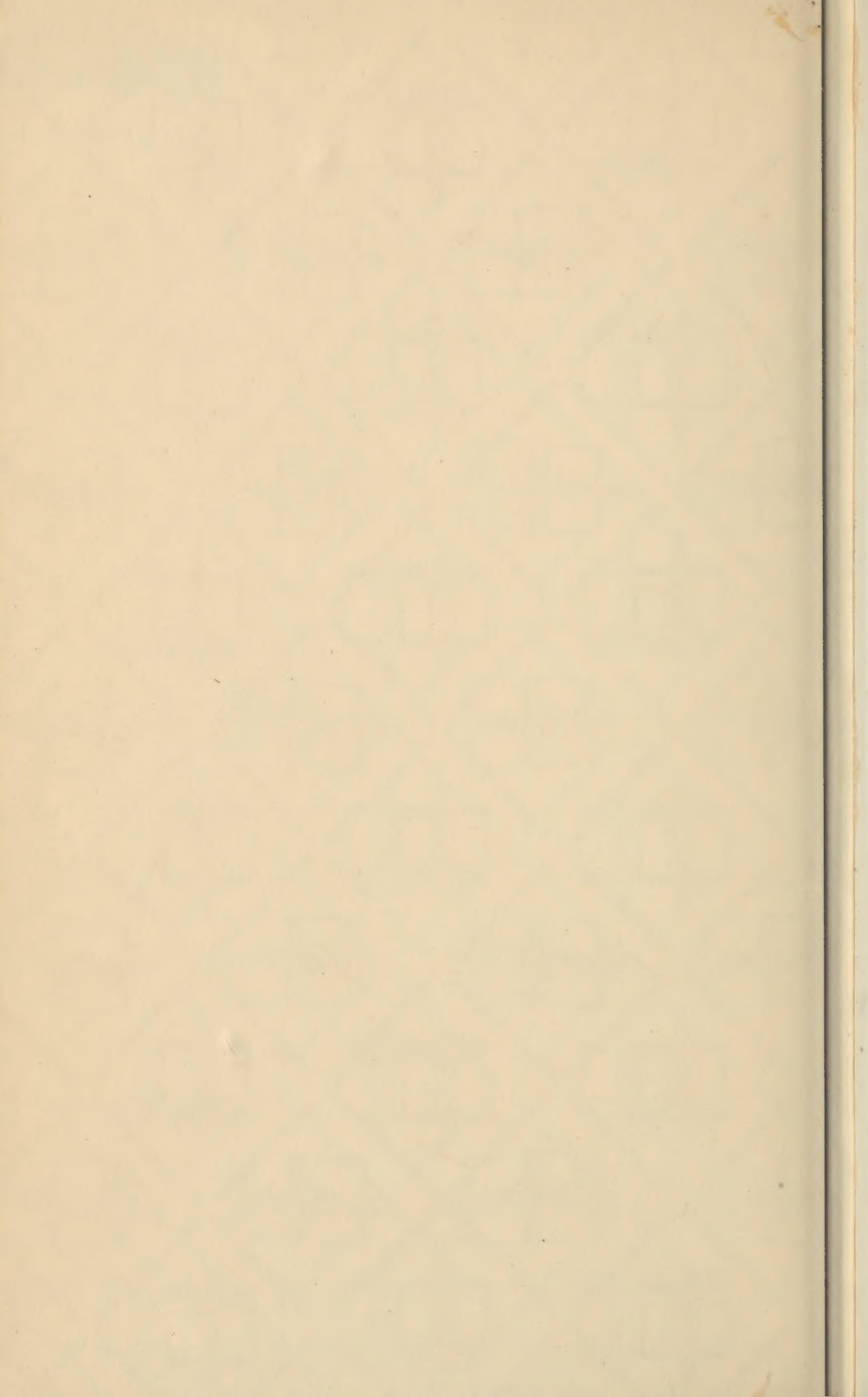
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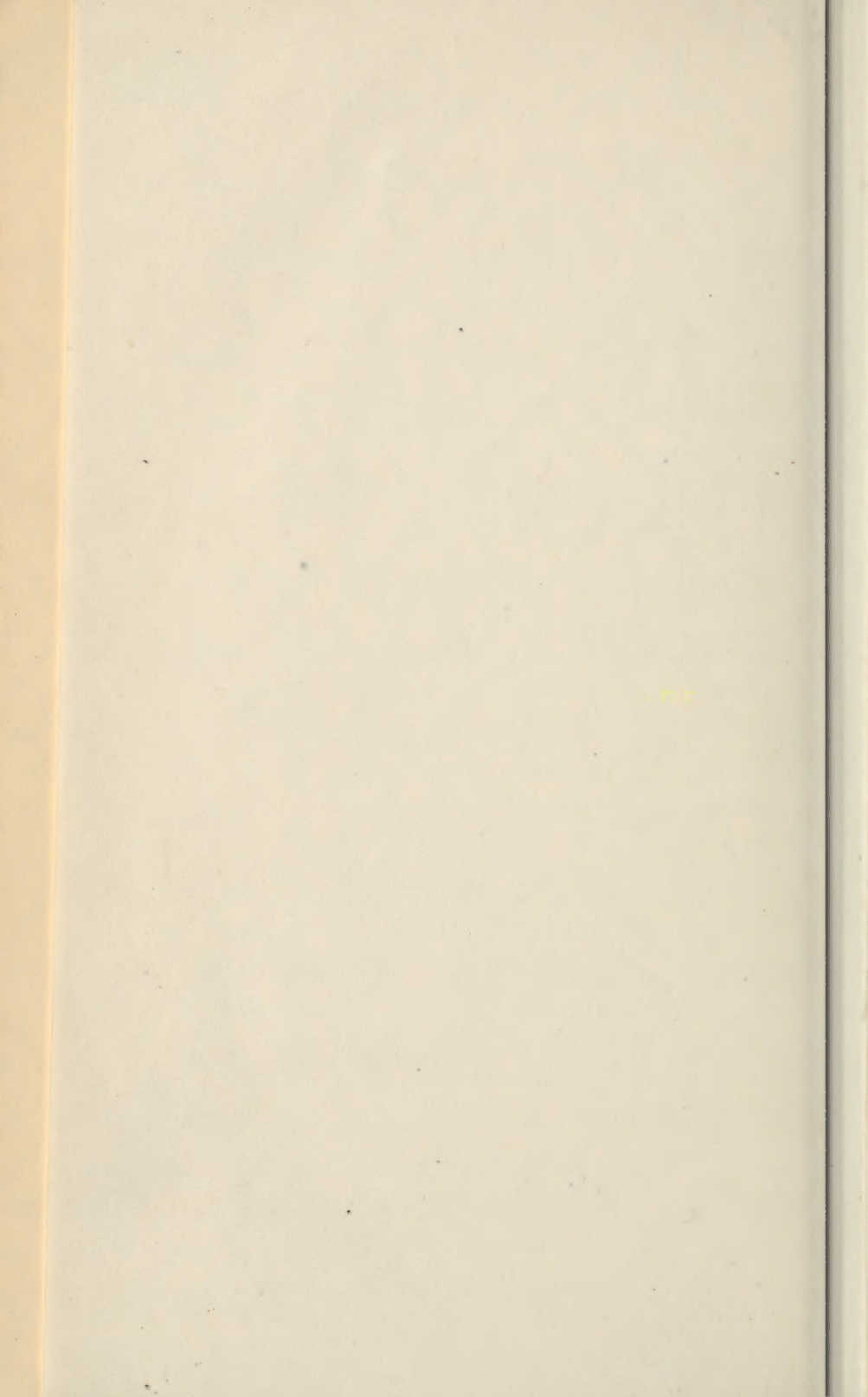


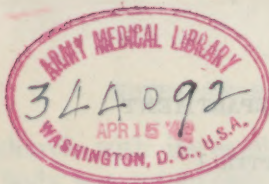


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AVIATION MEDICINEApproved for distribution of
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Box 1247

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CHAPTER 1

PSYCHOLOGY

SECTION I

GENERAL

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1. **Historical sketch.**—*a. Origin.*—What is psychology? Historically it is the study of the mind. The word “Psyche” in Greek means the vital principle or life essence, and was variously translated “soul” or “mind.” Primitive man appears to have believed almost universally in the existence of a shadow-self or “other me.” Was not his shadow an incorporated self, aping his every movement, and appearing and disappearing in an unexplainable way? And in dreams he visited distant points and performed strange feats, returning to find himself where he had lain before sleep came. More than that, dead relatives and friends visited him in his sleep; was there not then an essence or a soul, an animating principle, that inhabited his body? It was an idea of this kind originally conceived by the Greeks which has been elaborated and refined, laying the foundations of psychology upon which we have been building ever since.

b. Aristotle.—Socrates taught to “know thyself” was the prime factor of wisdom. However, Aristotle was the first great psychologist. He attempted to show how the mind works. He insisted that the mind depends upon the body, and wrote a detailed description of sensation, attempting to lay down a theory as to the functions of the sense organs. He was unable to accomplish much along this line as he had little knowledge of the nervous system. He thought the soul was in the heart. However, he sounds very modernistic in his insistence upon observation and experiment. “Let us first understand,” he says, “and then seek causes.” “Dependence is to be placed upon facts, not reason.” Aristotle was also a great philosopher and logician, and the line of development that followed him was in philosophy and ethics and his psychology was largely overlaid and forgotten.

The early church with its emphasis upon the soul and its contempt for the body was not an encouragement to psychological thinking and for 1,500 years after Aristotle, practically all discussion was logical rather than psychological. However, interest in the nature of the mind never flagged, and there were significant undercurrents that later were to find each other and to unite and develop the direction of the main streams of psychological thought which we find today.

c. Descartes' dualism.—The question of the relation of the mind and body became paramount with Descartes in the 17th century. His conception of mind as thought alone, independent of the body, set one of the big problems of psychology which has not as yet been solved to the entire satisfaction of all concerned. This problem is historically known as dualism. He explained sensation, emotion, thinking, etc., in a purely mechanical fashion by what he called "animal spirits." The heart was the center of heat where animal spirits were generated. They were forced through the body by means of the nervous system. The soul was in the pineal gland; animal spirits impinged upon it and gave rise to consciousness. If soul and body were entirely independent, just how one could act upon the other occupied the attention of many succeeding philosophers.

By this time another school of psychology with another method of attack was in full swing. Scientific methods had made great progress possible in the physical sciences. Locke applied these to his study of psychology. "Mind is a passive agent," he said, "upon which the world or reality acts." There are no innate ideas, as the philosophers had declared, but our minds because of their essential structure tend to work in a certain direction.

d. Locke and Wolffe.—Locke was followed by Christian Wolffe; and it is to him that most of the present psychological terminology should be credited, as he was the first to write in the vernacular (German). He made the distinction between rationalism and empiricism, which is important to remember because present day thought still draws from the same sources and employs the same methods. Wolffe used both of them. He divided the mind into faculties, and his psychology had great influence upon German thought and education, and through them upon English and American. Reference to faculty psychology is still heard. Locke had wrought an enormous revolution; he was the first modern scientific psychologist. His method, the method of observation and experiment, had to await development of biology and physiology as well

as instruments of precision, but the scientific method has been the recognized method in psychology since his time.

e. Theory of the unconscious.—Meanwhile philosophy, following the rational method but availing itself of the newer scientific knowledge, had brought forth the theory of the unconscious. This theory had had a long history, and had been struggling for expression since man began to think about himself, but the philosopher Von Hartman was the first to state it clearly. (“Mental events,” he says, “are passive reflexes of checked or inhibited psychological activity, as well as reflections of an absolute unconscious will and thought activity, which controls innervations and associations.”) According to his teaching, the unconscious thus plays a predominant part in the vital phenomena of the individual; in it is the essence of life; it forms an organism and maintains it, repairs internal and external injuries, and is the ultimate guide of its movements. It is the source of instincts, of intuition, of the aesthetic sense and of creative genius. The concept of the unconscious was exceedingly fascinating to a certain type of mind, and since Von Hartman’s time it has been extended and elaborated, worked over and restated, becoming purely spiritualistic in the hands of one school and just as purely materialistic to those of another. There are other schools that have fought it tooth and nail.

f. Methods.—(1) The Nineteenth century was a busy time for psychology. Men of different temperaments interested themselves in it, and as human knowledge broadened in other fields, the problems of psychology came to be attacked from many different angles. St. Augustine had long ago touched upon two methods of observation of mental process, the outer and inner. The latter is historically known as introspection; that is, the study of mind consists in the careful observation of one’s own mental processes. Its critics say that it is an impossible procedure; that the very attempt to observe a mental state changes that state; that at the same moment to have a mental state and to observe that state cannot be done; that the mind cannot divide itself to study itself. To this the introspectionists retort that the mental state is not observed at the time it is happening, but is examined a moment later, and this examination of a remembered state is accurate and does not alter the process investigated. Moreover, the practiced observer gets into the introspective habit, gets the introspective attitude ingrained so that it is possible not only to take mental notes while the observation is in progress without interfering with consciousness, but even to jot down written notes as the histologist does while his eye is still held to the ocular

of the microscope. Introspection is a valid method for a large body of psychologists yet today.

(2) The laboratory or experimental method had its rise in the nineteenth century. Elaborate techniques and instruments of precision were developed to study the relations of physical and mental processes in their mutual relations. Both introspection and observation were carried out under experimental conditions. William Wundt established the first psychological laboratory in Leipsic in 1879 and soon thereafter G. Stanley Hall organized one at Johns Hopkins. Knowledge of mental processes has been enormously extended through the experimental method. The laboratory is now as essential to psychology as it is to chemistry or physics.

g. Issues.—The issues of psychology became more sharply defined as relation of mind and body, nature of consciousness, and validity of the unconscious. Descartes' dualism developed into the doctrine of so-called psycho-physical parallelism. This theory asserts that mental and physical processes run parallel, are correlatives, but that there is no casual relationship between them.

2. Consciousness.—*a. Origin and nature.*—Consciousness was defined as "subjective facts, the elements of sensation, feelings, thought, acts of willing," etc. (Sidis). Consciousness is something that the psychologist postulates as the geometrician postulates space and as the physicist postulates energy or matter. The geometrician does not inquire into the nature of space or attempt to prove its existence; he assumes it and builds his science upon that assumption. So the psychologist assumes consciousness, and the question of its nature is outside his ken, none of his business. Most modern psychological investigation confines itself to this field, considering any further study of mind to be the province of the philosopher and the metaphysician.

Other psychologists cannot rid themselves of the need for something more than a blind interplay of energies in the realm of life's activities. Such workers usually speak of distinctive tendencies which are inherent in the nervous organization of the individual. It is these distinctive tendencies, they say, that give life the appearance of purposefulness. These distinctive tendencies are hereditary but the problem of the origin remains. Here again this school says that this problem does not concern them but is metaphysical.

b. Nervous system affect.—Consciousness is believed by a large group of psychologists to be dependent upon the nervous system. The fact that mind seems to develop parallel with the nervous system indicates this. The climax of evolution both in behavior and in

structure and connection of the nervous system, being found in man argues for the intimate relationship between mind and the nervous system. It is the function of the nervous system to regulate and coordinate activities of the various bodily organs as well as to put the individual in touch with his environment. The lower in the evolutionary scale, the more simply organized is the animal, and the less his higher centers are developed. Instinctive and reflex action take care of him. However, when the point is reached in evolutionary ascent where something more is needed to enable the animal to survive, consciousness then develops. For this study of the nervous system became of great importance, and biology and neurology became prerequisites to psychology. This is the type of psychology almost universally taught in colleges.

c. Behaviorist theory.—The view of the individual as a complex organism which is stimulated by and reacts to environment can be carried a step farther. Why inquire anything except behavior in relation to environment; why not make psychology the science of behavior in this sense, and dispense with the whole complicated formulas of mind, consciousness, and mental processes, and the developments from them? Why not make psychology purely objective, and study the individual as an animal that of course can give no introspective account of what goes on in its consciousness, if anything goes on. This is what has been done by the behaviorist schools.

The origin and nature of consciousness have formed one of the perennial problems of psychology. Is it anything more than an activity, a process, and what kind of an activity is it; is it defined when it is called awareness, or the "immediate antecedent and condition of behavior;" can it be defined at all, or is it justified even to say that it exists?

3. Unconsciousness.—The philosopher Von Hartman formulated the theory of what he called the unconscious. Pathological mental conditions, neuroses, and psychoses have always existed, likewise the phenomena of dreams. Various investigations into these states seem to render the hypothesis of the unconscious a highly tenable one. The phenomena of automatic writing, of hypnotism, of sleepwalking and other automatic activities, as well as the symptoms of neuroses and psychoses, found an explanation in the doctrine of the unconscious if the unconscious be conceived as the entire past history of both race and individual.

The psychology of the unconscious, with its emphasis upon behavior and the search for the meaning of acts, has been called dynamic in distinction from the older static psychology, whose concern is

chiefly with the structure of mental states. Under Freud dynamic psychology developed psychoanalysis. By this method the secrets of the unconscious are laid bare, and it is largely used in mental therapy, especially in the neuroses.

4. Scope.—*a.* It is seen that psychology is not a single subject, nor does it mean the same thing to all its devotees. It should be remembered that—

(1) Historically it is the study of the mind, though mind has never been satisfactorily defined.

(2) It has developed from man's effort to understand himself as a living, feeling, thinking being.

(3) For nearly 2,000 years after Aristotle its method was rationalistic, seeking to get at the laws of mind through reason; with development of scientific methods, psychology followed suit and adopted the empirical method.

(4) The psychology of today does not agree as to the nature of its subject matter or as to the best method to pursue, and is divided into several different schools.

(5) As good a working definition as any is that it is "The study of the behavior of an organism in its efforts to adapt itself to its environment."

b. The point of view taken herein is that psychology is the science of both consciousness and behavior. It deals with two orders of facts, namely, facts of consciousness observed introspectively, and facts of behavior observed objectively.

5. Definition.—*a.* Warren defines psychology as "the science which deals with the mental interrelation between an organism and its environment." He then points out that the environment affects the organism resulting in consciousness, while the organism responds to the environment resulting in behavior.

b. In this interrelation the nervous system, particularly the cerebrum, occupies an important and unique position, for neural activity is the immediate antecedent of behavior and is at the same time experienced as consciousness. In fact consciousness and neural activity are related as two aspects of the same thing. It is therefore possible to study neural activity objectively through behavior, or subjectively by means of introspection.

6. Parts.—*a. General.*—However psychology is defined it is customary to divide its field into four main parts, adult, child, animal, and social. Each of these parts is further subdivided. The first two, human, are divided into normal, and abnormal, which is sometimes still further divided into subnormal, supernormal, and patho-

logical. It must be borne in mind that by the term normal is meant merely the usual or that which is near the average, and abnormal is that which deviates greatly from the average. Abnormal and pathological need to be distinguished also. Abnormal implies deviation above or below the average; a man may be abnormally short or abnormally tall; he may be mentally subnormal and be very dull or feeble-minded; or he may be supernormal and be a captain of industry or even a genius. Pathological involves the concept of disease and of disorganization which prevents the usual function.

b. Abnormal child.—Abnormal child psychology has had considerable development. It is only in the last half century that any attention has been paid to the child as differing from the adult. Even though a great body of observations has been collected, real scientific study of the child mind has not progressed very much. Adults always study it, and are bound to interpret the child's behavior in terms of adult mental processes. Objective psychology seeks to obviate this danger by placing the child under experimental conditions and observing its behavior just as an animal. In practice child psychology seeks to discover subnormal and supernormal children.

c. Social.—Social psychology is the study of the behavior of the individual in relation to the group. It is an interesting and important field and one coming to engage more and more attention.

d. Genetic.—There are other divisions almost too numerous to mention, though often they are little more than names for points of view. Genetic psychology studies development of mind, both the individual human from the embryonic to the adult stage and development of mind from the lowest animal stages up to the human. In the study of primitive peoples especially much light has been shed upon present human behavior. The psychoanalytic school has dug deep in this field in the study of myth and folk-lore and the customs of primitive peoples, though some would class this work as anthropology.

e. Applied.—In applied, psychology has come out of the laboratory and is making itself useful in many ways.

(1) *Educational.*—One of the most important is educational psychology of which there are various kinds. It studies such subjects as measurement of capacity or educational attainments, learning process, manifestation of instinct and emotion, and application of psychological fundamentals to school work. Specific tests and scales have been developed for measurement of proficiency and progress in various subjects.

(2) *Commercial or industrial*.—Commercial or industrial psychology is the study of those mental processes which are important in trade and industry. This field is receiving much attention at present.

(3) *Criminal*.—Criminal psychology is another branch of applied psychology which is very interesting. Prisoners, delinquents, and criminals are studied; many courts now have psychologists attached to them and much valuable material has been gathered.

(4) *Individual*.—Applied psychology is based on individual psychology which is largely the study of individual differences in mental life. Out of individual psychology have come the studies on character and personality, and on special abilities and disabilities. An essential part of its method has come to be mental measurements. Mental measurements grew out of experimental psychology. The most important name in this branch of the science is that of Alfred Binet.

It is a truism, of course, that individuals differ from each other in mental ability, in personality, in character, but even yet how great the differences of original endowment really are is far from realized. As long as psychology employed only observation, whether outer or inner, it was difficult to determine the varying degrees of what is known as intelligence and traits. There is at present a widespread interest in mental tests; tests for special ability and aptitude, and in trade and industrial tests. Vocational selection has come out of the laboratory and is now an important part of the system of every efficiently run organization. Business today is not content with the old haphazard method of selecting and assigning personnel. "Square pegs in round holes" is now known to be the greatest waste in industry.

In aviation medicine individual and social psychology are most important. Of necessity work is done with individuals, and the questions of personality, of character, and of original endowment become of paramount importance.

Physical make-up determines basic type and from this personality trends and traits which furnish leads in predicting reaction tendencies of one kind or another are inferred.

From this brief outline something of the vast field covered by psychology is seen. Nothing living is foreign to it. Psychology is concerned chiefly with the human mind, regardless of how it may be looked at, whether as the sum total of experience, conscious or unconscious, or as behavior, a knowledge of it in its usual or normal manifestations is indispensable in the selection and care of flying personnel.

SECTION II

SUBJECT MATTER

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7. General.—Wherever human behavior of any sort takes place there is a psychological fact. It may be said that psychology is the attempt to take a scientific view of human behavior. It may be desired to try and understand human nature, and to know in what way psychology can be of help in arriving at this understanding.

All know a kind of amateurish psychology based upon common sense and experience. To understand people and size them up in a kind of intuitive way is attempted. Estimates of people as to various traits such as honesty, industry, loyalty, temperament, intelligence, etc., are formed. Certain reactions of individuals to specific situations may be predicted. Early in life it is learned that a certain kind of conduct meets with approval and another kind with disapproval. Facial expressions of pleasure and displeasure are mastered with a high degree of accuracy by all children. All playmates are catalogued with a fair degree of success. It is known just how much or how little teasing this one will stand, all their tender points, those who will fight and those who will not. In addition, persons know about themselves, kind of music preferred, people liked, the things liked to do, etc.

All these things in a crude way are psychological judgments. They could not however be called scientific judgments because they are often prejudiced and based on insufficient observation, and so often are erroneous. Persons have certain prejudices and dislikes, but to know why requires more careful and scientific analysis than they are ordinarily able to make.

The fictitious views of human nature commonly held are due to a lack of understanding. People behave in ways that are startling. Many feel that civilization is bankrupt, and that ideals are lost. The trouble is that ideas of human nature were, for the most part, matters of dogmas, creeds, and taboos handed down by a generation steeped in superstition and folk ways. Social, religious, political, economic, and ethical theories were based on old-fashioned fictions about mankind.

The older philosophers, being much learned in matters of books and abstract ideas, constructed in thought an imaginary man. About this

imaginary man they held various beliefs in advance, notions usually devised to suit the purpose of their particular philosophical system. These notions, although well intended, often represented the philosopher's rebellion against what he regarded as medieval superstition. He had been taught that man was a sinner, that his nature was corrupt and prone to evil. The application of reason to the facts of nature was greatly revolutionizing the old medieval picture of the world about him, so he concluded that a like revolution of the views of human nature was in store. In this he was probably correct. But what he often did was merely to say that whereas medieval thinkers had said that human nature was all bad, modern knowledge must declare it to be naturally good. Teachings of this kind are found in Rousseau, Kant, Plato, and Aristotle. Consequently, most political and social theories are based upon views of human nature which at best were pure assumption and guess work. The old thinkers did not go out and study man. They simply imagined an ideal man and endowed him with certain traits. Later, when people found that men were not really that sort of beings, they were inclined either to condemn human nature as a whole or fear for the future of civilization.

It is found, after more careful study, that human nature is variable and that basically it is neither good nor bad; and with better understanding and control, and only so, may it achieve something.

While many have been theorizing and generalizing about human nature and repeating old dogmas, scholars have gone to work gathering scientific data by controlled experiments in laboratories and clinics. About 100 years ago, the first scientific experimental study of human nature was begun. Since then the work has broadened and at present enough facts have been gathered to give what is on the whole a very important science.

8. Importance of psychology.—In modern times a scientific view of human nature is needed. This fact cannot be emphasized too much. Present-day environment has become so much more complex than that of older generations, this change having come about because men have learned to apply to its control principles of cause and effect. To cope with and adjust to such a world, new habits, new judgments about ourselves and about our neighbors, new ideas of values of experience and the possibilities of human achievement, and more about the control of human nature must be learned. To measure in terms of human happiness and effectiveness various social movements in which participating must be learned, and what human types these various movements are encouraging must be known. What traits can be modified by education and those which are heredi-

tary and unchanged by environments must be known in order to apply energies where advance is possible. A more accurate way of estimating capacities of ourselves and other people is needed so as to place the right man in the right place. How best to educate the young is a most important question, and a greater knowledge of self is needed which will give the inner hidden motives of actions so that individuals may not be tricked by unconscious emotions and impulses; so that behavior and thinking may be relevant to the situation at hand; so that energy will not be wasted in ineffective gestures, the functions of which are often merely to bolster up unconscious childish egoism.

9. Psychology as a science.—*a. Psychology a true science.*—In the beginning psychology was not a true science. Until recent times it was a branch of philosophy. The chief concern of the older writers was about such things as the nature of the soul. What its attributes were; how it was related to the body, and how it came to possess knowledge. Much of the difficulty psychology has had in trying to establish itself as a science has been its attempt to discard these old philosophical habits of regarding the mind or soul as something distinct from the life process itself, and concerned primarily with knowing. It was knowing, not behaving, that concerned the older psychologists and they thought of knowledge as something outside the process of nature.

Writers of the seventeenth century were concerned principally with origin and nature of ideas, and with attempts of human understanding. Hume, at the beginning of the eighteenth century, though he also discussed emotions or "the passions," was still chiefly interested in the "human understanding." Mill and the British and German psychologists had the same interest down to the time of Herbert Spencer. In the early part of the nineteenth century, the German psychologists, Weber and Fechner, attempted to measure sensation units. This was the beginning of our experimental psychology. Up to the time of William James, the great problem was still the question whether the mind consisted of "a knower" who existed outside of, and independent of his ideas, or was in some way the sum and substance of the ideas themselves.

In the latter part of the nineteenth century, after biology and physiology had made such strides in laboratory methods, psychology definitely broke away from philosophy and began to be in a true sense a natural science.

It may be said that psychology is today a natural science in that it takes a natural history point of view of human experience and be-

havior. Psychology proposes to study this side of human nature in the same spirit and with as few metaphysical assumptions as would be found in the sciences of physiology and anatomy in their study of the human body. It should be remembered that psychology is a science still in the making, and has many problems yet to solve, and has not as yet achieved its true position as a science in all its studies of human nature.

b. Science characteristics.—(1) In general, a study must have achieved, before it properly may be called a science, scope, method, and laws or principles.

(a) *Scope.*—It must be clearly understood what the study is about, what facts should be included in it and what should not; for instance, anatomy studies the structure of the organism.

(b) *Method.*—There must be a generally accepted way of conducting the study. The method must be such that any trained worker can use it. Hearsay information or that gained through divine revelation may be information, but it has no place as scientific fact.

(c) *Laws or principles.*—Data which have been collected for study will be found to be related in certain ways, and laws or principles will be evolved to explain this relationship. These laws and principles must be universal in application, and the simplest laws which explain the most are most acceptable. The more clearly these laws can be stated in quantitative terms, the more valuable they are. Psychology authorities are in much disagreement in all three of the above important matters.

(2) *Scope.*—The scope of psychology is hard to determine. On one side the line of demarcation between psychology and physiology is not sharply defined, and on the other it has never completely divorced itself from philosophy. Psychologists of different schools accuse each other of mysticism and metaphysics. Some maintain that psychology is “the science of the mind” and would include consciousness within its scope, and others maintain it is a “science of behavior” and that nothing but behavior should be included.

(3) *Method.*—The method is another strongly debated question. In fact, there are two or three different methods. Until recently the “introspective method” obtained, and much psychological experimentation was conducted by the use of this method. This method, while valuable, fails to measure up to the ideal standard desired by science. The material studied is so subjective that it is difficult to get men to agree as to the facts. Recognizing the limitations of this method, some investigators eliminate it entirely and say that psychology can be scientific only insofar as its methods are purely

objective. Watson's school, commonly referred to as "behaviorists," will not admit that the introspective method is scientific at all. This school has attempted to reduce psychology to an observation of the law of mere stimulus and response. This is the method employed in animal psychology. The animal has no way of communicating its findings and ideas if it has any; the investigator depends solely upon the reactions or behavior of the animal for data.

Just about the time when behaviorism was making itself known in America, a new school of thought in psychology appeared in Germany. This school used the word "gestalt" and is generally known as the "gestalt school." The term gestalt is a common German word meaning "shape" or "form." Often "pattern" conveys the idea. For psychological use "configuration" is a term frequently used.

Like other developments, it is a revolt against the old established order. It did, however, revolt specifically against associationism which dominated the field so long.

Associationism had two characteristics: It aimed at analysis, and it was concerned mostly with the intellectual side of life. It sought for the simplest processes of knowing, and accepted simple sensation as the elementary process out of which complex experiences and ideas are built up.

While behaviorism revolted against the intellectual bias of the older psychology, and insisted that man or an animal must be taken as a moving or behaving organism, gestalt psychology revolted against analysis as the fundamental problem in psychology. Behaviorists said "we must analyze behavior, not experience." Gestalt psychologists said "we shall never get far in psychology by analysis of either behavior or experience." Behaviorism rejected the old phrase "association of ideas" in favor of association of stimulus and response; while gestalt psychology believed that the whole idea of association was misleading. Both rejected sensation, at least elementary sensation, but for different reasons; behaviorism because a sensation is not a motor response, and gestalt because it was supposed to be an element or atom of experience. Behaviorism favored the reflex as the psychological element, and accepted the idea of conditioned reflexes as showing how complex behavior was built up out of the elementary reflexes. Gestalt was as opposed to the simple reflex as to the simple sensation. Behaviorism rejected introspection because it purported to reveal experience instead of behavior, while gestalt had no objection to introspection in a broad sense, but did object to the analytical type of introspection which was used

by the older schools as the only genuine method of obtaining psychological data.

The older schools insisted that experience comes in complexes or compounds, not in elements, and the job of psychology is first to analyze these complex processes into their elements and then to study how the elements are combined and the laws of their combination. The gestalt psychologists called this a brick and mortar psychology, with emphasis on the brick because the trouble was to find the mortar. Some argued for a mind, or soul, or ego as the agent that did the combining.

The gestalt school introduced into psychology the notion of "form quality" or "pattern quality." A form quality is property possessed by a whole which is not possessed by any of the parts making up the whole, for example, a melody, a group of dots. Different forms, figures, or patterns can be made out of the same elements, and the same pattern out of different elements. The property of wholes deserved psychological study as well as the properties of elements.

This theory originated by Wertheimer but was developed by several psychologists. It emphasizes the principle that structural totalities must be the units of mental activity. The chief work of these observers has been done on perception and they have striven to show that perception is not and cannot be merely a bundle of elements of experiences, but must possess a unity and structure of its own. For example, suppose a line is thus drawn ○. An observer would perceive this as an incomplete circle, that is, the circle would be perceived as a whole and then its attribute of incompleteness added. They insist that all perceptions are structural totalities having a definite structure before they can be perceptions.

The gestalt psychologists urged that the properties of organized wholes furnished the most important problem. In the studies of mankind, they insist no true picture of a personality is obtained by listing and studying the various traits, giving a rating of individual traits and finally placing these ratings side by side in a table or diagram, or worse still, assigning a numerical value to each trait and then taking the sum as the rating of the personality. Such a table, diagram, or rating fails to show which trait is central and dominating in the individual's personality and which traits are of secondary importance in his case. It also fails to take into consideration how well the individual traits blend into a whole. The personality is not a mere sum of traits, but an organized whole, a gestalt. This is true with all mental processes. They lay stress on the paramount importance of the whole rather than the component part of the or-

ganization. This applies to personality with special force, for an individual is not a mere bundle of sensations, images, wishes, emotions, sentiments, nerve cells, gland activities and so on, but a structural totality, depending not only on these component parts but on their relativeness to each other and to the whole.

The solar system, for example, is an organized whole, a physical gestalt. Other examples are a soap bubble, electric systems. Organized wholeness is the guiding principle upon which this school has built its foundation.

(4) *Laws*.—Finally there is the problem of laws in psychology. In any science the laws are always open to revision as new facts are discovered and new relationships among these facts are noted. As yet many of the psychological principles are open to revision and perhaps always will be. Psychology deals with individuals and if we could succeed in reducing the behavior of an individual to formulas which apply alike to all individuals, it is obvious that that which is distinctly personal in every one should thereby be ignored completely. Psychology may develop laws which apply in a general way as explanations of human behavior, but the very nature of its subject matter is such that it can never be wholly reduced to quantitative formulas.

While there is a vast amount of disagreement among psychologists, there is fair general agreement on three points. All scientists agree in holding "an evolutionist view of mental life," that is, they believe that the psychic nature of man, whatever it is desired to call it, lies within the process of the development of the animal organisms, and great as are the mental differences between man and animals, there is after all no sudden break anywhere.

Again, there is fair general agreement that "mental life is chiefly concerned with bodily activity." Third, there is fair general agreement that the "criterion of effective mentality, indeed perhaps the very criterion of truth itself, is to be found in the facts of adjustment to environment."

(5) *Application*.—Applied psychology is a branch which is receiving much attention. Psychology has here come out of the laboratory, and is playing a vital part in practical things. Here psychology strives to understand and explain many things which have escaped general notice, and to use knowledge of human nature in order that the behavior of people in definite situations may be predicted and controlled. Applied psychology is used, for instance, in determining efficiency, in vocational selection, advertising, education, which in-

clude intelligence testing. People are all striving for a philosophy of life which works, and psychology will help better to relate the individual to reality. The old intellectualist or rationalistic philosophy was itself largely the result of ignorance about psychology. The older philosophy is passing, and as it passes many sociological and other fictions about human nature are passing with it. In a sense psychology shows us that intellect and all its works are instruments by means of which man is coming to control the forces that play upon his life. With a better knowledge of human nature, how best to govern and evaluate human behavior may be learned.

10. Value in aviation medicine.—*a.* Is psychology of any practical value; if so, how and why? These questions may be answered by first giving some general idea of the training system and the method of selecting trainees in vogue at the Army flying schools. Trainees are obtained from the commissioned personnel of the regular army and from civilians between the ages of 20 and 26 years who have had 2 years' college work or its equivalent. The civilian trainees come into the service as flying cadets. About 81 percent of those taking flying training are flying cadets.

Flying training consists of 8 months' primary training and 4 months' specialized or advanced training. Applicants for flying training are subjected to a very rigid physical examination, commonly referred to as the 64 examination for flying. About 80 percent of those applying fail to pass this examination. About 55 percent of these rejections are for what are ordinarily termed physical reasons, and the other 25 percent are rejected for various psychological reasons. To illustrate results of the examination, consider that twelve applications reported for examination: five will be rejected for strictly physical reasons, two will be rejected for psychological reasons, and two will be rejected on both physical and psychological. Three, or 25 percent, will qualify for appointment.

Follow by classes some of these highly selected groups of individuals who have successfully run the gauntlet of all the examinations, physical, psychological, mental, as well as having been carefully scrutinized by the cadet board, and have finally been accepted as flying cadets. Surely much should be expected from this favored group. The mesh of the net through which they have passed is exceptionally small and should have caught and eliminated all the weaklings. The accomplishment of those remaining should be great, but unfortunately such is not the case. The following are training records by classes:

Date	Total number in class	Total number graduated	Percent graduated	Total number elimi- nated	Percent elimi- nated
September 1926-----	204	40	20	164	80
March 1927-----	221	29	13	192	87
July 1927-----	111	40	36	71	64
November 1927-----	102	38	37	64	63
March 1928-----	117	40	34	77	66
July 1928-----	119	50	42	69	58
November 1928-----	110	62	56	48	44
March 1929-----	119	48	40	71	60
July 1929-----	135	47	35	88	65
November 1929-----	131	43	33	88	67
March 1930-----	129	32	25	97	75
July 1930-----	127	46	36	81	64
November 1930-----	133	52	39	81	61
March 1931-----	129	46	36	83	64
July 1931-----	122	39	32	83	68
November 1931-----	220	101	46	119	54
March 1932-----	198	88	44	110	56
July 1932-----	199	90	45	109	55
November 1932-----	197	84	43	113	57
March 1933-----	166	75	45	91	55
July 1933-----	156	70	45	86	55
November 1933-----	165	72	44	93	56
March 1934-----	157	66	42	91	58
July 1934-----	156	68	44	88	56
November 1934-----	144	77	53	67	47
March 1935-----	120	55	46	65	54
July 1935-----	139	52	37	87	63
November 1935-----	151	83	55	68	45
Total-----	4, 177	1, 633	-----	2, 544	-----

Out of 4,177 who began their flying training between the years 1926-35, 1,633 successfully completed the course and were graduated as military aviators. There were 2,544 who were unable to measure up to the training standards and had to be eliminated. These figures represent 39 percent success against 61 percent failure. This 61 percent scholastic mortality is extremely high.

The question is whether to be satisfied with a system so wasteful of manpower and finances.

The Association of American Medical Colleges is much alarmed at what they call the high scholastic mortality among medical students. A. S. Begg in a survey found the percentage of failure ran

fairly constant between 10 and 20 percent. Columbia University during the past 5 years claims an elimination record as a result of poor scholarship of less than 2 percent. Educational institutions are constantly trying to develop ways of excluding these weak students from gaining entrance despite the fact that the student is ready and anxious to pay all his expenses.

A comparison of the percentage of graduates of the Army flying training department with these civilian educational institutions follows:

	Percent graduates	Percent scholastic mortality
Medical schools.....	80	20
Columbia University.....	98	2
Army flying training.....	39	61

These results indicate that civilian educational institutions are much more efficient in percentages graduated.

When taking into consideration the difference in the type of performance involved in the various training systems, together with the degree of perfection of skill demanded by the flying department, perhaps the selection and system of training now in use at the Army flying schools is as efficient and economical as can be expected. If the system is assumed to be inefficient, the inefficiency rests only in one of two places, selection system or training system.

b. Medical officers are neither qualified nor called upon to judge the training system; it is none of their concern or business. This leaves for their consideration the question of selection. This is very much their business and responsibility.

As long as there has been a Medical Department of the Army, it has been the responsibility and job of this department to make the physical selection of the personnel for each arm or service. It establishes the physical standards and makes those standards such that it feels confident the soldier chosen will be capable of accomplishing any future tasks to which he may be assigned. If from experience it is found that personnel selected are not measuring up to expectations, then either change the system of selection or revise the standard until personnel who will be suitable or successful are selected.

Obviously, when considered in terms of training accomplishment (61 percent failure), the material now being selected for flying

training is not suitable. However, it is believed the present method of selection on a purely physical basis is highly efficient and little chance of improvement may be expected from that direction. That leaves only the psychological part of the examination.

It is the opinion of most who are closely associated with the training department that nearly all the trainees (61 percent) who fail do so because of some psychological factor. This is the big problem for the Medical Department and it is the value of psychology in aviation medicine.

SECTION III

METHODS

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11. General.—As with any new science the definition of psychology has been a much debated question, and has changed from time to time. Psychology was first known as the “science of the soul.”

The older philosophers regarded the soul as an immaterial substance that had an independent existence and was separate from the body. It was not an object of immediate awareness by an individual, but was rather an unknown principle that gave mental life its unity and coherence. The soul was thus a metaphysical concept and as such could not be a subject of scientific inquiry.

Later investigators regarded psychology as the “science of the mind.” Some considered soul and mind analogous, and this change was chiefly a change in the term used. As the term “mind” began taking on a different meaning, there was a corresponding change in the conception of the term as used in psychology. This line of thought developed into the doctrine of the psycho-physical parallelism. The mind was considered to be independent and separate, and was made up of unrelated faculties such as attention, memory, etc. Insofar as mind was considered as outside the experience, it was like the older concept of soul, not a subject for scientific study.

Psychology was next known as the science of “consciousness.” Consciousness, as distinguished from soul and mind, is equivalent to immediate experience and includes such processes as perception, imagination, feeling, etc. At this stage psychology became a truly

empirical and inductive science as distinguished from the older or rational or deductive psychology. In other words, psychology now became a study of facts, but facts of a special kind, facts of consciousness.

The structural psychology attempted to analyze consciousness into its various parts and elements. It attempted to obtain a cross section of consciousness at a given moment. This analysis would be in terms of "mental states." The functional psychology was more concerned with a longitudinal section. It was more interested in the sequence of events rather than with their analysis, and treats of the "stream of consciousness."

Later the term "science of behavior" was adopted by an ultra-scientific group of investigators. This school believed that psychology should dispense with consciousness altogether and devote itself exclusively to the study of behavior.

In this manual attempt will be made to maintain a conservative and open mind and try to follow that great middle body of psychologists who do not admit allegiance to any of the schools. Good work is recognized and utilized wherever found.

According to Warren "psychology is the science which deals with the mental interrelation between an organism and its environment." The stimulation of the environment affects the organism resulting in consciousness, while the organism responds to the environment resulting in behavior.

12. Study.—*a.* The methods used in the study of psychology are essentially the same methods as are used in other scientific studies, the one exception being "introspection" or subjective observation. This is the type of observation used in the study of consciousness, in fact it is the only approach to a consideration of this most important phenomena. To fail to report on consciousness would be to ignore that which is most important to the understanding of a human being.

b. The objective method is the method of choice and is used wherever possible. It satisfies all the demands of a scientific procedure. Behavior as studied under controlled or experimental conditions is one of the chief sources of our psychological data today. A comparative study of animals has added much to knowledge about human beings. The study of children and abnormals contrasted with normals has been a fruitful source of information.

13. Value.—*a. Mediocre character of action.*—There is no complex instrument used by man with so little regard for its efficiency or with so meager knowledge of its laws of operation as his own system

of nerves and muscles. The reasons for this are obvious. First, psychology is a relatively new science and is just beginning to discover the fundamental laws of human behavior. Second, the average man is satisfied with a mediocre performance. This is true regardless of the task. Third, many persons are afraid of thinking too much. To think may be strenuous, but no more disastrous than vigorous physical labor. Man avoids thinking whenever an easier method is possible. Knowledge would go far in bringing a realization of inefficiency.

b. Unreliability of memory.—Memories are proverbially inaccurate. Psychology reveals the reasons for this fact, and shows how to minimize errors of recall.

c. Vocational application.—The biggest waste in industry today is caused by trying to fit men to jobs rather than jobs to men.

d. Medicine.—The old family physician understood to a high degree the application of psychological principles in the practice of medicine.

e. Education.—Psychology finds its widest application of all in education, for mental development is a function of environmental as well as phylogenetic factors. Upon adequacy of psychological knowledge depends the optimum rate at which children should be encouraged to develop, the extent of which education can be made to fit the needs and types of pupils, and the extent to which they will profit in later years by their earlier education.

f. Socialization of individual.—During the educational period, extending over 8 to 16 years, much can be done toward molding the individual so as to meet better the demands of modern society. By socialization of the individual is meant developing in him such attitudes toward other persons, social groups, races, and his own and other governments, as will make him a useful, constructive, and efficient social being.

g. Mental hygiene.—It is as easy to distort the personality of an individual as it is to retard or accelerate his mental growth. Personality is easily influenced by training and environment. A stable personality rests upon a proper balance of likes and dislikes, upon an appropriate satisfaction of natural impulses and upon a sane interpretation of social and economic values by those who train the child.

h. Leadership and knowledge of human nature.—Our system of government and social order is guided by a small group of individuals. The behavior of the masses depends wholly upon how well this selected group applies the knowledge of human nature. These leaders of society therefore owe to society the obligation of understanding human nature as thoroughly as possible.

14. Methods.—Every branch of science must conform to the methods of investigation which science has found to be valid. In addition, each branch must develop specific procedures called techniques, which it alone uses. These specific techniques must not violate the general principles of scientific procedure.

Psychologists study behavior scientifically for the purpose of making more exact predictions, and predictions of a greater variety than can be made merely from a common-sense knowledge of human nature.

In general the knowledge about human behavior acquired without effort and serious study is very incomplete. "Practice makes perfect," but few know why practice brings better results at one time than another. A psychology casually acquired contains many errors. There is a strong popular belief that a person can "feel it" if he is stared at when his back is turned. All are familiar with the common belief in so-called compensations. "A person who was weak in one trait was strong in another, or had a compensating strong one." Study of the problem has shown these beliefs not proven by facts.

The science of psychology contains not only more facts, but facts of greater accuracy than are to be found in popular opinions about human nature.

All or a large percentage of knowledge about human behavior has been determined since the investigator adopted the scientific method of study.

15. Essential steps in scientific procedure.—Psychology, the youngest of the sciences, must be strict in compliance to all the rules of a scientific method.

a. Awareness that a problem exists.—Before proceeding to any scientific endeavor it must be recognized that there is a problem for solution, or there may be simply dissatisfaction with things as they exist and a feeling that there is possibly a change which will improve things.

b. Data.—(1) *Accumulation.*—Great care must be exercised to assure accurate data. For this purpose instruments of precision are used whenever it is possible to do so. Descriptive units in qualitative values are not satisfactory if others may be obtained. Accumulation of data alone does not constitute scientific procedure.

(2) *Organization.*—After facts are gathered they will be found to be related in certain ways. Scientific procedure undertakes to classify these facts as they come to hand. Classifications must be recorded as tentative to be shifted, if necessary, as new materials are added. Failure to observe this caution has led to the fallacy that succession

indicates a casual relationship. For example, thinking of an absent person being followed by that person's appearance.

c. Formation of theories.—With facts organized, explanatory theories naturally present themselves. Theories are working hypotheses. They stimulate thinking, raise problems and issues, and lead to new discoveries. The theories should never be regarded as proved until they have been tested by experiment.

d. Experiment.—Every scientific experiment begins with a working hypothesis which is to be tested thoroughly. The hypothesis should be tentative, however, because a prejudice or a preconceived notion on the part of the observer may produce mistakes in results, or at least wrong interpretation. The essence of experiment is to eliminate all variables and to permit only one factor to operate at a time and to observe with careful checks and instruments of precision the results of this one factor.

e. Prediction.—The final test of the validity of a scientific finding is predictability. Statement must be made in advance not only that a certain event will occur, but when it will occur, how long it will last, and if possible, how much energy it will involve. Prediction should include measurement. This is the ideal; however, the events that are studied in psychology are often too complex and variable for mathematical expression. On the other hand, the science of psychology aims to refine its methods until definite measurements are possible.

f. Degrees of scientific certainty.—While the goal of science is such complete certainty based on experimental evidence that absolute predictability is possible, findings in any specific field vary in their approach to the goal so that there are degrees of validity ranging all the way from sheer guesses to absolute laws. The student needs to keep this fact before him, and to learn to evaluate the facts displayed.

In attempting to evaluate different hypotheses, certain principles are of aid.

(1) Theories substantiated by experiment are the most valid. When it has been tried out by experiment under carefully controlled conditions with all possible variables either held constant or eliminated except the one in question, the results are worthy of great confidence. The procedure in administration as well as handling the test scores must be thoroughly standardized.

(2) Theories based on analogy are unreliable. The layman or unscientific individual is very likely to take a forceful analogy as a very striking argument, whereas it is the weakest possible argument.

(3) Sweeping generalizations are dangerous. For example, brown-eyed men do not train well.

16. Specific techniques.—Each science develops its own techniques. In psychology this has been extremely difficult because of the intricacy of human nature. These techniques at best are imperfect, but they have yielded much valuable data.

a. Introspection.—The essential nature of introspection is the observation of one's own mental processes. This is most difficult. Mental activity is never simple, and to observe its complex activity at any one time and report accurately upon it requires considerable skill. The limitations of it as a method are realized, and yet it is the only approach available to the study of consciousness. Much information has been obtained through introspection in the study of sensations, feelings, and emotions, and some forms of intellectual processes.

Introspection is a method peculiar to psychology because psychology studies conscious behavior. The procedure is undertaken always for the purpose of isolating from very intricate human reactions certain aspects, features, or parts for specialized study and control. This procedure in many ways helps to understand the character of the complex reactions with which started, and to relate them to other reactions of like complexity; hence it aids in classifying the various modes of behavior. Moreover, introspection gives the conscious settings in which behavior takes place. It is important to know about these settings because without them isolated events cannot be understood in their relationships, and there is no information as to what events to isolate. A knowledge of human behavior is incomplete so long as there is no information available concerning such processes as thought and feeling.

b. Whole-part relationship.—Structural analysis reduces a whole to its parts, while functional analysis preserves the whole. This statement introduces us to the problem of what the relationship is of the whole to its parts. The whole cannot be assumed as the sum of its parts. The human being is something more than an aggregation of muscles, bones, and nerves, as is shown by the fact that the total organism exhibits a behavior which no one part is capable of exhibiting. The organism as a whole may determine to a considerable degree the behavior of its parts. A whole disappears when we reduce it to its parts. What constitutes the difference between a whole and its parts? Most writers agree that the whole exists in its own right and that the terms "organization" and "unity" describe the difference.

c. Observation of behavior.—Observation of controlled behavior of an individual in varying situations is another technique psychology has developed. Some types of behavior are very easily observed. In others the activity, the overt act is not so apparent. (Example, mental multiplication.) Dependence must be placed upon the report of the individual under observation, which is introspection.

d. Statistical.—The statistical method was devised to interpret diverse material which otherwise would be too cumbersome to analyze. Statistical data should never be assumed to obviate the need of experimental verification. Experiments and not statistics furnish the ultimate criterion.

e. Case study.—This method has the same application in psychology that it has in medicine.

f. Use.—While these various techniques are valuable at various stages in the study of psychological materials, they are merely aids in the execution of the scientific procedures outlined. Experimentation, that is, observation under controlled conditions, is the only way to verify a hypothesis.

SECTION IV

ATTENTION

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17. General.—For the scientific psychologist there is no single faculty of attention. In the analysis of consciousness and behavior no one process can be isolated and named “attention.” The phenomena which are generally included under this heading are of many different sorts. Some may be studied best by the objective investigation of behavior, some by a process of introspection.

18. Nature.—*a. Development and control factors.*—The phenomena of attention is of much concern to all. Set to some task, the mind wanders to a foreign subject in spite of every effort to keep attention upon the subject at hand. How to learn to control attentive processes so as to hold to the assigned task and to suppress or hold in check irrelevant thoughts and ideas leading away from the problem of adjustment confronting the individual at any given

moment is a question. Individual and racial progress as well as survival are involved in this important question.

The processes attend the situation at hand; evaluate the possibilities involved; put stamp of approval upon the behavior considered adequate to the situation, and then pass on to other things important to the well-being of the individual and race. Survival demands that attention be ever on the move.

There is no time in a person's waking life when he is not attending to something. When it is said a person is inattentive it is not meant that he is attending to nothing, but that he is not attending to the thing desired. If a person looks with a vacant stare, apparently not hearing a word uttered, it is not because his mind is a blank, but because he is thinking of other things. He is preoccupied.

There are times when a person may apparently go into a reverie and be lost to all around him. When he "comes back" he may claim that he was thinking of nothing and that his mind was a blank, but investigations have shown that in such periods of "absence" there are mental processes at work, often of a very vital importance to the individual.

This indicates that the question how can ability to attend be increased is equivalent to the question how can the fluctuations of attention be controlled. There are varying degrees of alertness, and some persons go through life half asleep because existence to them is a succession of drab events none of which has sufficient significance to make them attend. If life is filled with striking experiences, there is no trouble keeping awake. The development of attention is centered almost exclusively around the problem of how to direct the attention to a series of objects or thought processes which are of enough vital significance to keep one alert. Development of attention is, in short, development of ability to control the movements of attention.

At any one moment of waking life some things are very vivid while others, although aware of them, are not so clear. There is evidence to prove that there may be influence by sensory impressions of which one is totally unaware. It may sometimes be thought that there is selection, at each moment, of one single item of experience and response to it, but careful investigation shows that conduct is determined, not by one item alone, but by the entire combination of elements which make up the total situation.

There are often contradictory elements in the mass of impulses which are present at any one moment. If all opposing elements were evenly balanced, they would neutralize each other so that a state of equilibrium would exist and no action would occur. Such

a situation seldom exists. First one element is dominant and then another. The momentary dominant stimulus, the one which controls to a large extent the response, is the one attended.

Attention means that one element plays a dominant role in behavior. Attention to a stimulus, whether an external or an internal ideational process, is simply to say that reaction to it is more strong than to other stimuli operating at the same time. Attention is therefore the name for a process by means of which some element, or small group of elements, becomes selected from a mass of stimuli and controls behavior for the moment.

Furthermore, it must be kept in mind that the relative force of the various stimuli is constantly changing. Noises, lights, tactile impressions and internal stimulations are all playing on the organism with varying degrees of force; all are in contest for complete control of reactions.

In addition to the changing character of competing stimuli, another factor which may determine the nature of the reaction made is the readiness of the organism to respond in any one manner. The mind may be "set" to react in a certain way so that even the slightest suggestion will divert attention into the chain of reverie for which the mind was set. That is, the mind wanders from the thing at hand because the nervous system is "set" to think about other things.

A very important characteristic of attention is that it continually fluctuates, and this fluctuation is an essential element in the process of adjustment. Attention cannot be kept on one specific form of experience for long at a time. This does not mean that the idea cannot keep recurring. In some instances attempt is made to prevent some thought from dominating the attention but it insistently returns. Analysis shows that it does not stay in the mind, but as soon as another thought displaces it, it again gains the ascendancy.

Attention may be fixed on one general subject but fluctuates when permitted to attend to the variously connected details. This fluctuation is of advantage in that instead of fixing attention on a minute detail in a manner that would lead to stagnation, one detail is grasped and then shifted to another related detail, and again to another. Fluctuations then become an essential element in the process of adjustment. They make possible continually changing reactions in harmony with the changing situations operative around and within. To stop the fluctuations of attention should never be attempted, but rather learn the laws of fluctuation and thus direct their shifts.

The shifting character of attention makes possible investigations into details of experience. When an individual cannot keep his

attention on a thing it indicates the need to get more intimately acquainted with the subject rather than to control attention. The printed page cannot long hold the attention of one who cannot read, but let the details of that reading matter be known, and there is little trouble in following the type. In order to control attention, the individual should learn the meaning of the experience he encounters and shifts of attention will follow this meaning.

b. Scope.—(1) *Vision.*—How broad attention is in scope can be tested by exposing the senses for a fraction of a second to a varying number of objects and determining how many of them can be perceived during this brief exposure. In the field of vision the tachistoscope is used. The shutter of this instrument remains open one-quarter of a second. Five separate impression can be distinguished. More than five shows confusion and the examinee will make errors in reporting the number seen. The span of attention is definitely increased by arranging the material in a meaningful manner. If jumbled letters were shown, it is quite likely that the exposure would be insufficient for perception of all of them. If the letters be arranged so as to give them meaning, they can be grasped on the first exposure. In the illiterate the grasp is much less, even as few as two or three letters because each of the letters is of itself complex. When more material is given than can be perceived, it can be described only vaguely. Therefore, the general conclusion may be drawn that when more items are presented to view than the span of attention can accommodate, they are either vaguely seen as an indistinct experience, or they are comprehended as a meaningful whole. Consequently the way to increase the span of attention is to give material meaning.

Practical application of this principle is found in advertising. A headline containing more than five words has been found to confuse rather than attract the attention of the reader. Most good advertising contains only a few major points but calls attention to these in a decisive way.

(2) *Other senses.*—The span of attention in senses other than vision is not so easy to determine. It is difficult to distinguish the components of a tonal blend. In most cases the tones stand out dominantly and the others appear to change its quality. It is easier to distinguish successive tones than simultaneous ones. From these facts to use the senses to the best advantage must be done not by measuring the span of attention, not by increasing the number of discrete objects distinguished at any one time, but by training to give meaning to the different impressions.

By attention is meant that certain elements of experience are dominant in consciousness. It is seen that it is the result of competing elements and that this competition results in continual change in the element which is dominant. The question now arises as to what factors determine which element will gain ascendancy.

19. Determinants.—Conditions within an individual that determine which things he will attend are called subjective determinants of attention. Other factors relate more to the stimuli which impinge on his sense organs; these are called objective determinants. It must be remembered that in actual life they do not function separately, but always in very intricate combinations. These determinants decide which shall be dominant.

a. Objective.—In considering the objective determinants of attention it is found that—

(1) An intense stimulus gains attention. All other things being equal, an intense stimulus will attract the attention more effectively than a weak one. The operation of this principle is not a simple one. If a loud sound had only to compete with a weaker one of the same quality, if a bright light had only to compete with a fainter light, and similarly with other stimuli, the problem would be simple. In reality however when a sound stimulus is given, it usually has to compete not only with other sounds of the same or different quality, but also with sights, tastes, odors, pains, and a vast number of other stimuli of all degrees of complexity. Even if equivalents could be given in terms of the various sense perceptions or in physical energy, the comparison would not be accurate for the organism might be better equipped to respond to one type of sensory stimulus than to another.

(2) Quality of the stimulus affects attention. Experiments have shown that yellow is a better “attention getter” than other colors of equal physical intensity, that is, there is something qualitative about yellow which attracts attention. It is on this principle that all airplane wings are painted this color for easy spotting in case of a forced landing or a crash. It is also the principle of which advantage is taken in camouflage.

Similarly, there are certain qualities to tones or tone combinations which stand out. This factor should not be confused with meaning which is a subjective condition. There is something in the very nature of certain stimuli themselves which makes them striking to the observer. In some instances what is usually considered quality may be the resultant of a peculiar combination of sensory impressions. This is doubtless true in the auditory realm and probably in others.

The speaker with a good delivery arrests the attention of an audience whereas one with a blatant voice may fail.

(3) Large objects attract attention. The size of the stimulus is related to attention. This has its important consideration again in advertisement. Attention is not the only consideration which determines the value of the size of an advertisement. There are certain other conditions which tend to favor larger advertisements such as cost of erecting, giving the impression of prosperity, hence the reader is inclined to favor that product. The factors making size valuable must also be known. Due authority concludes "with increasing size of space there does not go an increasing attention effect, but that the effect is about equal to the square root of the area."

(4) Repetition of the stimulus attracts attention. The first stimulus may go unnoticed, but if repeated will force itself into attention. If the face is stroked or any other movement made, it may not be noticed, but if done several times it will probably come to attention. It is the repetition which calls attention to the act. For the same reason the intermittent ringing of an alarm clock is more likely to awaken the sleeper than its continuous ringing. There is a point, however, beyond which repetition ceases to be effective. One may become accustomed to the stimulus. If a faucet drips water it may be very annoying at first, but after a time it is not noticed. If repetition is to be effective, it must have a continued or changing significance. The power of repetition has also received consideration of advertisers in that advertisements are repeated over and over. Here again other factors such as the facilitating of memory play a part. Utilization of repetition to the best advantage depends on the proper balance between it and monotony because when repetition becomes monotonous, it is a stimulus to inattention rather than attention.

(5) A novel stimulus attracts attention. The object at the focus of consciousness, the one to which the individual is attending, has the most dominant influence on reactions. If something familiar comes to the attention, reaction to it is in the customary manner and it ceases to occupy the focus. If it is not familiar, it is this uncertainty, this doubt which makes the object remain in the focus of attention.

All are familiar with the operation of this principle. If a woman walks down the street with a hat on, the model of years ago, she will attract a great deal of attention; or when a couple dressed in clothes of the vintage of the last generation appear, they attract a crowd more than the expensively dressed shop windows which have been designed for that purpose.

Interest is primarily in the secondary results of attention. All want to attract attention, but if this is followed by ridicule or scorn, it is ineffective from the practical standpoint. The confronting problem is to arouse interest which will end in a favorable reaction.

(6) The effectiveness of some of the objective determinants of attention may be summed up in the word "change." It is probable that change is the most effective stimulus to attention. The change is effective if it is from a mild intensity to a strong one, but it may be just as effective if it is in another direction. Let a noise suddenly stop and one is immediately aware of the change. Persons have difficulty adjusting themselves to a soundproof room. They are ill at ease. They miss the noises about which they have complained and cannot ignore their absence. Let a clock stop ticking, and it is noticed even if its existence was unknown. The seemingly oblivious telegraph operator is immediately attentive when his station call is sounded.

b. Subjective.—Subjective determinants are of as great importance as are the objective determinants and favor or oppose any particular stimulus. These subjective determinants have been much misunderstood because of personal reactions toward them. There is a feeling that there can be arbitrarily selected the thing to attend, and bend the energies toward that end. When in spite of this something else gains the focus, it is believed it is because the energies have not been exerted to a sufficient degree. The commonsense notion has been to strive harder to attend, to bend all energies toward banishing irrelevant ideas and favoring those relevant. It is however futile.

The subjective factors may be summed up in the word "interest." When interested in a subject, there is no need to force attending. Realizing this some individuals have attempted to force themselves to become interested. Interest cannot be developed by force. Interest is not static. It changes with age, with training, with emotional patterns, and with every experience of life.

(1) Some stimuli are natively more interesting than others. A child responds to a loud sound, a bright light more readily than to a symphony, a painting, or a speech. These latter have no meaning for him even though he is equipped for intense sensory stimuli; his reactions are largely proportional to their intensity. Because his responses are unorganized, his reactions are usually short-lived. Consequently he responds first to one impression and then another. He is distractable. This is the result of the fact that all his values have equal subjective values. His interest is vague and fleeting because his impressions are vague and his responses will be unorganized.

A child's interest may be aroused by teaching him the significance of specific situations and not by moralizing about the value of interest as such. The same principle applies to adult interests. If an adult will not attend to a particular stimulus it is because that situation has little or no meaning to him.

(2) Meaning stimulates interest. A person's response may be inadequate, or it may even appear wrong to another person but it nevertheless has meaning for the one making the response. Meaning is then nothing but familiarity. Show a book to a little child who cannot read, and the printed page will have no interest at all. If he is older, he will want to see the pictures. If too young for this, he will want to tear the book in order to hear the pages rattle. These latter are meaningful experiences; in the former instance the pictures have the meaning. In later life the printed material is the most interesting. Childhood interests often persist and color adult interests. Adults enjoy looking at the pictures in a book. Hence adult interests are not so different from those of a child; they are merely more complex because experiences have given them more meaning.

(3) Uncertainty stimulates interest. If known too well, a thing is likely to lack interest. Interest is stimulated, however, if confronted with a situation to which exactly how to respond is not known. There must be just enough uncertainty to arouse a little fear of results. If fear is too pronounced the interest may turn into a tendency to retreat from the situation. There must be enough meaning in it to enable guessing what to do. Reading the last chapter of a book or getting someone to tell you how it turns out destroys the interest.

Persons sometimes wish to foresee the future but few really want this power even if it could be granted. The spice of life is the uncertainty of the future. If this were removed, there would be no thrill in speculating about it. All work tends to become monotonous and uninteresting. It is the mysterious future that in some vague way stimulates an interest in continued efforts or work. If men are in a constant fear lest they lost their jobs they will not work well, but on the other hand, if they see nothing better ahead, they will become indifferent.

(4) Emotional habits determine interest. When a situation first attracts attention, it is due to a combination of external and internal conditions which may be the result of pure chance. As a result of this, meaning is derived and emotional reactions to the total situation may be pleasant or unpleasant. If favorable, there follows a tendency to favor that situation and to investigate details. This adds

more meaning and fosters still a more favorable emotional attitude and gives a stronger impetus to attend to things related to the situation. Many likes and dislikes for certain foods are based on this factor. The food fads of adults and the intensity with which they adhere to their likes and dislikes bear constant testimony to the permanence of emotional interests

Many a professional interest is built up in this way. A boy may become interested in a stone by some chance circumstance which may eventuate in a permanent interest in geology. If on the other hand this first interest leads to unpleasant emotional experience, he may develop a positive dislike for geology. If a professional man could trace his interest in his profession, he would likely find that it was initiated in some trivial experience, later followed by others which aroused his curiosity in the subject matter of the profession and furnished the drive for continued interest and enthusiasm. A physician should not have to force himself to be interested in his work and to attend to its details. If he does, something was lacking in his introduction to his profession or in some later experience in connection with it.

All this points to the conclusion that attempts to force the attention of the child upon some subject are futile. Forcing may develop an antagonism which will persist indefinitely. It is known that college students dislike mathematics and the majority of those who take it do so only because it is required for graduation. There is no inherent reason why mathematics should be more uninteresting than any other study.

Continued attention to any general subject or to any professional activity is based on development of a favorable emotional attitude toward it.

20. Motor adjustment.—*a. General.*—With attention there is likely to be an adjustment of the sense organs so that the stimulus may become clearer. Attention is not merely sensory clearness and an inner attitude; it is a response. A sensory stimulus may be present and at the same time be totally ignored if attention is centered elsewhere. In a game a hand may be hurt, but while the excitement of the game is on the hand is not noticed. After the excitement of the game is over, the individual suddenly senses pain. Immediately he begins to suffer and suffers intensely. Once the impression comes to the focus of consciousness, there is a tendency for the sense organ to adjust more accurately so that the sensory impression may become clearer.

Vision of the peripheral portion of the retina furnishes another example. The peripheral stimulations are usually not so clear as those falling on the fovea. Without changing the fixation point of the eye, the objects on the periphery can be seen more clearly merely by focusing attention on them. There is temptation to turn the eyes so that the attention may be focused where it can make the greatest impression. If this attempt is blocked, the attention may still be directed to the vague peripheral object which becomes relatively clearer through the mere shift of attention.

The fact that the adjustment of the sense organs is vital in the attentive process should be considered when an attempt is made to secure and maintain the attention of an auditor or reader.

Attention is not only awareness, it is a response. Man is a living organism, responding at all times to the situations in which he finds himself. A man selects specific features of his environment to which to respond. He responds to the dominant feature and the one that has come to the focus of attention, but also to a less degree in most instances responds to other things which may not be at the focus. He responds to the whole pattern of stimuli which impinge upon his sense organs.

b. Types.—It is, therefore, obvious that the attentive process involves motor adjustments. When attending to a visual stimulus, either actual overt responses or incipient responses are made to what is seen. The same may be said of the responses to other sensory stimuli. There are various orders of motor responses. Types are—

(1) Projection of one's self into the situation confronted. A man who clenches his fists when he sees a fight illustrates this type of response.

(2) Emotional abandon. A person may gaze at a work of art and permit himself to be carried away with it.

(3) Result of a more or less logical analysis of the situation. This is the one most generally desirable. If speaking to a person, not a mere utterance of articulate sounds but a logical response and a reaction to what is said is what is desired.

Those who try to influence others must learn to interpret from the expressive activity of the other whether he is attending and to what he is attending. He must be unobtrusive if he wants the person to be influenced, to attend to his message. Many a good sales talk has been diverted from its logical effectiveness because the salesman had a gold tooth which dominated the attention of the buyer.

21. Control.—Attention in order to be efficient must function effectively and practical hints in its control are—

- a.* Distractions must be overcome.
- b.* Attention must be kept active and on a specific subject.
- c.* Attention of the other person must be held.
- d.* Attention must be diverted from unpleasant subjects.
- e.* Attention of the other person must be diverted.
- f.* Movements of attention must be guided by interest and any task will be easy.

22. Process.—Attention seems to be general unification of activity, expressing individualization of the organism. It does not refer to any defined self-acting process.

The process of attention is a unified orientation of behavior. It implies a socialization of the phenomena of static or dynamic activity in a certain direction, and the arrest of activity in other possible directions; an inhibition of all forms of behavior which do not accord with the dominant orientation.

The greater the stimulation, the greater the reaction of attention, that is, the more intense will be the inhibition and more marked the orientation. Under the influence of this stimulation the change of behavior will be more rapid, the movements more prompt and more precise, the efficiency will be increased. Here are all the essential characteristics of the process of attention and of its levels which represent levels of efficiency of behavior.

These characteristics are encountered in a measure in the functioning of the infra-cortical nerve centers in man and other mammals. The individuality of the organism implies a coordination of automatic activities and reflexes. This requires reinforcements and inhibitions electively distributed. The precision in this coordinated distribution of reinforced or restricted actions and the energy of these actions may show various degrees. But it is above all in the functioning of the superior centers regulating the mental processes; that is to say, in the unified behavior, that the attention has the greatest importance and manifests itself more obviously.

The intensity of attention is a function of the interest involved, either the natural and direct or the secondary. In other words, the intensity of attention is a function of the magnitude of affective factors orienting behavior which frees energies in the direction either of release or of arrest; and of the disposable quantity of energy which is distributed in the form of static or dynamic forces and expresses itself in the form of more or less numerous inhibitions.

These activities and inhibitions in the case of thought are exclusively associative in nature.

In the case of great fatigue after strong emotions or prolonged insomnia, the capacity of attention, the affective value of the stimulus remaining constant for the individual, will be notably diminished because the disposable energies are at a minimum.

Certain individuals have a less capacity of attention than others, either on account of the feebleness of their interests or of the small amount of energy they have available. The latter condition is very noticeable among neurotics.

When the affective forces are equal, the efficiency depends upon the disposable energy. When the energies are equal, the efficiency depends upon the interests, that is, the affective force of the stimulus. It increases with the latter up to a certain optimum, beyond which the emotional perturbation with its diffusion of incoordinations will tend to diminish the efficiency.

The process of attention appears to be very complex. It seems to be the result of multiple factors transferring themselves under the form of greater or less efficiency in the one definite direction of co-ordinated activity of the organism.

Any attempt at measuring attention would involve the measuring of efficiencies. These efficiencies are measured from points of view which may differ considerably since they involve, in the execution of a prescribed activity, both absolute magnitudes and speed. A given task may be performed more or less well or quickly. Perfection and speed must both be considered in assessment.

In a continuous activity, it is found that efficiency does not remain constant, but presents spontaneous oscillations which are shown in the speed of perceptions or of movements, in the strength or precision of acts.

These oscillations are normal and differ relatively little from one individual to another. But the stability of efficiency depends above all on the stability of the interest, in observation of directions, in the definite orientation of the activity. The strength of the subject's resistance to external stimuli may be determined by a continuous record performance.

On the other hand, by changing the task at a given signal many times in succession, and by comparing the efficiency attained in each of these tasks, the plasticity, the adaptive flexibility of the effort of attention during these changes are measured.

Similarly, if a person must perform several simultaneous tasks, what will happen to the efficiency in the execution of both tasks

together, compared to the efficiency in the execution of each task separately?

It is found that those individuals who were most competent to undertake several tasks at a time, also those who could change most easily and quickly the general orientation of their activity, had the most suppleness of attention.

Various methods have shown that the change of orientation occurs very rapidly, in two or three tenths of a second, and so in the course of a second one is able to return very nearly twice to each of two tasks executed at the same time.

23. Factor in trainees and pilots.—The state of development of attention is of vital concern in selectees for flying training. The desirable type of individual must have this faculty developed to the proper degree. Too highly developed a degree of concentration may well make a dangerous student. Frequently cadets are washed out with the comment of the instructor that they are tense, enter traffic at the wrong place, and are oblivious to other aircraft in the vicinity, a fault usually ascribed to carelessness. Such an individual more probably had developed the faculty of attention to such a degree that he is capable of attending to but one thing at a time. Early in his training career he is so intent on keeping the ship on an even keel that an approaching plane fails to attract his attention. His whole consciousness is absorbed in the nose of his own craft and a small segment of the horizon. This is the plodding type of personality; the individual who can and does concentrate on one particular thing until the goal is reached in spite of all else. He may make an excellent airplane mechanic where capacity for infinite detail is at a premium, but his lack of ability to shift quickly his attention from one thing to another precludes the possibility of his becoming a military aviator.

On the other extreme is the distractable individual, the one whose attention is so susceptible that it will not remain fixed long enough for him to comprehend the meaning of any of the stimuli he so rapidly receives. Such a one will probably not make a success of anything he undertakes unless it be the promotion of fake schemes. In an airplane he will take instruction poorly; he will be unable to keep his attention on the subject of the day's instruction. When the instructor is trying to get him to pay attention to the position of the ship in a gentle bank, he will be concerned with the gyrations of some distant stunter.

The exact technique and details of the chandelles, a maneuver requiring deep concentration and study, he never will be sufficiently

skillful to accomplish. In time the instructor will report him as being unable to understand directions and being generally hopeless as a prospective military pilot.

The development of blind flying has emphasized the importance of attention in flying. The blind flying pilot is deprived of the many minor distractions that serve to arrest his attentive powers in open weather. He must keep his attention fixed on a relatively few stimuli emanating from the instrument board and at the same time disregard the false stimuli arising within himself which create false ideas of his position in space. More than ever is it important that pilots have just the precise development of attention for that particular job.

SECTION V

SENSE PERCEPTION

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24. General.—Medical officers are familiar with the role played by sensory organs in the economy of life. It is through these sense organs that the individual gains his immediate contact with external environment, as well as his internal condition. It may be said that the sensorium is the gateway through which the flood of impacts must pass in their route to and from the central nervous system.

Investigation reveals sensations to be irreducible conscious elements or primary conscious states. They resist further analysis. Although sensation is the first and simplest conscious response to a stimulus, the adult finds it almost impossible to distinguish the sensation from other conscious reactions which follow at an imperceptible interval of time. It is difficult to disassociate mere awareness of these strictly sensuous qualities from the awareness of the object. The expert trained in introspective analysis is able to isolate the sensuous qualities for study, but he finds it impossible further to dissect them or to reduce them to lower units. Sensations are irreducible conscious elements or primary conscious states. The attributes of sensation are quality, extensity, duration and intensity, but quality is in a definite sense the most fundamental thing about a sensation.

Although the study of the senses is a most fascinating one, it has not advanced far enough to have anything but theoretical knowledge

to put at the disposal of the student. One fact of fundamental importance has been established—that in some way not understood, the various qualities of sensory experience are correlated in fairly constant fashion with the specific modes of stimulation of sense organs that come to them from things around, so that these qualities of experience serve as signs of the presence of the thing from which such stimulations come.

In application the complexities of the quality of sensory experience serve as signs of objects; seldom are these qualities made the objects of thinking. Qualities as such seldom are of interest and are rarely considered in abstraction from the objects they represent.

There is little doubt that the range of sensory qualities differs from species to species, but just how much variation there is in individuals of the same species is not known. At present human capacities for sensory experience have to be accepted as a bare fact.

Psychologists usually define sensation as the consciousness of the qualities of the objects (including the body) stimulating the sense organs. These qualities are highly abstract affairs isolated for psychological purpose from the larger matrix of actual conscious experience of which they form a part. In general, when our sense organs are stimulated, there is consciousness of objects rather than of mere qualities. The objects are the things of importance. James has said sensations give mere "acquaintance with objects," whereas perception gives "knowledge about them."

Regardless of the vague and fleeting character of these sensations when considered in isolation, they are the basic material upon which the world of knowledge rests.

The energy from the external and internal world pours in through the sensorium and plays upon the central nervous system; here it is analyzed and synthesized into the various objects and meanings with which dealt in adjusting to environment. Knowing, cognizing, recognizing, or conceiving are fundamental functions or faculties of mind. The consciousness of objects, or "thinghood" is technically called perception.

25. Processes.—From an evolutionary standpoint the beginnings of perceptive processes undergo an expansion from the simple to the more complex until finally a conceptual consciousness with ideative and affective components is reached. When protoplasm such as a protozoon is stimulated, a response or change occurs. As evolution progresses and the organism becomes more complex, it becomes dimly and gradually aware that changes occur in itself; a sense of comparison arises; finally sensations are produced. It is an aware-

ness of these sensations which constitutes the dawning of consciousness, and that it must be borne in mind that perception furnishes much of the subject matter of consciousness or awareness.

Consciousness acts whenever there is a transformation of physiological into psychical processes. It includes all the mental processes concerning which there is awareness, distinctly or indistinctly, at a given moment. Therefore it must necessarily include perception. Consciousness is made up of phenomena, which if they consist mostly of the continuous flow of sensations from all organs of the body to the brain are called permanent phenomena, or if made up mostly of perceptions of the outer world of reality are called epiphenomena.

There are three fields whereby the organism establishes and maintains its relations with the environment, namely, the psychosensory, intrapsychic, and psychomotor. The psychosensory field is controlled by the sensorium, whose function is perception. Through perception experience of the environment is gained and this is of course a prerequisite for adjustment by the intrapsychic and psychomotor activities. In man, the types of adjustment which are of most significance are those which involve definite use of the mind. The mind comes into possession of its knowledge through use of bodily senses, and makes itself effective through its control of bodily muscles. The sensorium, consisting of the sensory receptors and their pathways to the cortex, is responsible for sensations, of which percepts are the result.

26. Sensation.—*a. Definition.*—A sensation is defined as the consciousness of sensory quality. Sensations are the result of stimulation of specialized sensory end organs and comprise the mass of material of which mental functioning is composed. A perception is more real and concrete. In perception a group of sensory qualities is apprehended as an object; a mental image of an object present to the senses is formed. It follows that the only difference between percepts and ideas is the presence of sensory elements in the former, hence ideation closely resembles perception but does not deal with external stimuli the way perception does. The sensorium may, however, affect the psychomotor field directly without the intervention of consciousness, as in a reflex act. Here perception is not involved, except with the after effects of the act.

b. Quality.—Sensations are of various qualities, depending on the different kinds of stimuli which cause them and on the peculiar structure of the sense organs and nerves. Sensations are the mental "elements" resisting further analysis just as the physical elements do. They may combine in many ways to form many qualities of sensation,

and in addition they may form more complex entities such as percepts. In addition to being a mere combination of sensations, perception conveys meaning and involves apprehension of some of the relations sustained by the object perceived to other objects such as direction, distance, size, etc. An object is perceived in part by impressions of contact, temperature, color, smell, etc. The fact is that an object is perceived as such with a more or less definite fringe of relations.

c. Attention factor.—In addition to sensations or building blocks upon which perception is based, there is also a close relationship with higher faculties of the conscious process, especially the process of attention. Attention is the focal point of consciousness, and attention to a percept renders that percept clearer and more distinct. This fact is demonstrated in puzzle pictures. When the hidden part of the picture is discovered, that particular part stands out more clearly than the rest. Attention is a motor reaction placing the organism in an attitude whereby a percept attended to rises rapidly, clearly, and intensively into consciousness. It is thus a special variety of action or response to perceptual stimuli. Attention intensifies perception or sensation, makes it appear longer, and makes it enter consciousness more quickly. Attention is solitary but perception is generalized, that is, several stimuli can be appreciated simultaneously. Attention facilitates certain perceptions and inhibits others, as is shown by the fact that in performing an important experiment only what is relevant to it is observed, and everything else is lost to the senses. Thus it will be seen that many percepts are closely bound up with attention, there are also many percepts and sensations which fail to attain the focal point of consciousness. Proof of the motor quality of attention can be seen in the fact that voluntary or forced attention gives a sense of effort due to the muscular adjustments necessary for the best comprehension and appreciation of the stimuli.

d. Units.—As an adjustive process, perception represents very distinctly an organization of sensations into units such that practical motor responses can be made to them. A hamburger sandwich as a mere matter of sensation appeals to touch, sight, smell, and taste, to mention no other possibilities. In general, vision, hearing, and contact afford the predominant foci of perceptions.

27. Percept.—The general plan of the structure of the percept may be compared to that of the cell. A close examination of the cell reveals the presence of a central element, of a nucleus surrounded by cytoplasm with its meshwork, the cyto-reticulum. The nucleus forms the central and important structure having the functions of as-

simulation and reproduction. The nucleus and cytoplasm however are intimately related; the modification of one affects the other. Both nuclear and cytoplasmic structures form one organized whole, the living cell. Similarly in the percept we find a group of sensory elements which constitute the nucleus, and a mass of other sensory elements, possibly the main mass, forming the tissue of the percept. The nuclear elements are more intense and appear to be predominant in the total mental state; both, however, are intimately connected and go to form the living tissue of the percept. The nuclear elements may be regarded as the sensitive or vital points of the perceptual system. The nucleus of the percept cannot be displaced or modified without profoundly modifying or even completely destroying the life existence of the percept.

In the adult human being there is probably no such experience as that of a single pure sensation—it is an abstract thing, not capable of realization because of the vast previous sensory experiences of the individual. Life is in terms of percepts instead of sensations, because the sensations received are modified in consciousness by past sensations so that meaning is given to the new ones. The percept, then, is a sensation or sensations, with meaning. In the struggle for existence the animal organism must on pain of death be adjusted to the object of its external world. The central, nuclear elements of the percept, which are awakened by external excitations (sensations) give the cue for the reaction; they form the sensitive organization for the release of motor energy in definite directions; they signify a definite object to which correspond definite motor tendencies with final reactions of adjustment. To the cat, a dog is not an object of beauty or contemplation, but something to be chased or else run away from. The sensory stimulations coming from the dog are for the cat the dynamic essentials for his conduct.

The constituent elements of the percept are not of the same definiteness and intensity. The central nuclear elements stand out more distinct, more definite, and consciousness lights them up with more power and intensity. They are like mountain peaks standing out in the evening twilight; the valley below may be but dimly suffused by the glow from the sunlit peaks above. The central nuclear elements are in the focus of consciousness; they are made more clear by attention. Consciousness plays with its searchlight, attention, on the nuclear sensory elements, and the cytoplasmic or subordinate elements are of far less intensity, or may in fact be very indistinct; they are on the fringe of consciousness, and may for all practical purposes be subconscious. Yet, indistinct as they are, these subordi-

nate elements form the main content of the percept, giving it the fullness of reality.

The nuclear elements are the most pronounced and the most prominent as far as saturation of sensory quality is concerned. They have so much of their peculiar sensory quality that they diffuse it into the other elements; the subordinate elements appear under the sensory form of the nucleus; they become assimilated by the nucleus, and are saturated with its sensory coloring. This holds true not only in regard to saturation but also in regard to sensory brightness. The central elements possess a sensory brightness far in excess of other elements, and hence they shed their sensory light on the more obscure, though no less important sensory elements. However, what they illumine is not so much the peculiar sensory characteristics of those elements, but their own coloring with which they have saturated the total percept.

It has been mentioned that perception is closely bound up with attention. It is equally true that perception is strongly influenced by emotional or affective tones with which the sensations are pervaded. Affective tones arouse an attitude toward the external world in general and to the special object in particular. The whole organism is invaded by the subtle influence of the nucleus, giving rise to definite sensori-motor reactions, and intensifying the affective state which permeates the perceptual consciousness.

The affective state of the percept is not always obvious in cases of fleeting percepts but it becomes manifest when the central elements become temporarily fixed. The cat getting a glimpse of the dog may be taken as a good illustration of the affective states present in perceptual consciousness. The more sensitive the individual becomes to the least difference of the nuclear elements the better adjusted will he be to the conditions of the external environment, and the better will be his chances in the process of survival of the fittest.

As an example of how sensations of a certain class are given meaning to form a perception, take the fact that the eyes see not only colors and degrees of brightness, but also form. Perception of form involves other than visual sensations, yet in perceiving the form of a house a mile away we do not hear, smell, or taste the form, etc. The eye observes the position of objects in space; it distinguishes right from left, up from down, and near from far. It is not necessary actually to touch objects to know where they are in space. The judgment of distances and positions in space is not due to simple sensations, but to perceptions that have been gradually built up in experience. The meaning of a mile is known only after experience

in walking, or the significance of a yard is known after using objects of that or a similar extent. In other words, behavior in relation to these positions in space makes up the perception.

It is because of behavior in certain ways in reference to certain sensations that they have gained the meaning that they have, that they have become perceptions. The book seen has a meaning as a book in terms of what can be done with it, not simply in terms of its appearance to the eye. It is a book because it can be handled, its pages turned, and its contents read. Similarly the bell heard has a meaning insofar as behavior has some relation to it. If it is recognized as a dinner bell, the sensation means response in some way to the sound, either actually or in imagination. Conduct, either actually executed or merely pictured in the mind gives the whole meaning that the sound has as a dinner bell.

Meanings are made and changed in terms of behavior alone. An object that could not call forth any kind of activity in reference to it would be no object at all. Various objects and situations mean different things to different persons, insofar as they have behaved differently toward these objects and situations. It is a common fallacy to think that a situation means the same for everybody, and it must be remembered that the same object may have many different meanings for many different people.

Behavior is the criterion of true as contrasted to false perceptions. It can be ascertained only by conduct whether or not perception is correct. If the perception will work in subsequent behavior, then it may be reasonably sure that it is true; if it will not work, then it is false. Examples of this are plentiful in the realm of "optical illusion" pictures. The moving-picture industry, a form of genuine entertainment for multitudes of people, has been built up because of the fact that false perceptions, being easy to produce, can satisfy the individual about as well as true perceptions. When a talking picture is seen the actual auditory and visual stimuli received are of profound simplicity compared to the multifold and changing meanings given to the splashes of light seen on the screen as perceptions, which though false, seem very realistic at times.

There are two kinds of false perceptions, illusions and hallucinations. Both agree in the one essential particular, that is, that they will not work out consistently in behavior, but they differ in that an illusion is quite normal, while an hallucination is abnormal. The person who hears voices plotting his own destruction has generally no test by which he can discover that they are unreal, and others do not hear them. If all persons heard these voices and if on subse-

quent tests it was found that the actions of all could be based on the perception of these voices, then it should be concluded that they were real.

In discussing perception, the term apperception must not be neglected. It has been seen that perception is the interpretation of present experience in terms of past behavior. Apperception is a highly organized form of perception, being general attitudes toward large numbers of experiences. The businessman has one attitude toward the world of commerce, the lawyer another, the doctor another. The fundamental attitudes of individuals must be known if dealings with them are to be successful.

Language is a particular striking instance of the effects of experience upon perceiving. The words of a strange language may strike upon the ear in absolutely the same fashion in which they do at a later period after the language has been mastered. The sensations elicited in the two cases may really be to all intents and purposes identical, but the perceptions are radically different. In the first instance simply a mass of meaningless sound is heard; in the second, experience furnishes a host of interpretative meanings which are entirely missing in the first case. What is perceived at any given moment is quite as much determined by momentary interests, by past experiences, and the modifications which they have impressed upon the nervous system as by the particular object physically present to the senses. The sensible quality of even the printed word changes under the eyes. The French sentence, "Pas de lieu rhone que nous," may be read over and over again without recognizing the sounds to be identical with those of the words "paddle your own canoe." As the English meaning is grasped the sound itself appears to change. Verbal sounds are usually perceived with their meaning at the moment of being heard, but sometimes the associative irradiations are inhibited for a few moments, then suddenly their interpretation occurs. But at that moment often a change in the very feel of the word may be noted. This is probably why, if an isolated printed word is looked at and repeated long enough, it ends by assuming an entirely unnatural aspect. It is reduced by this new way of attending to it to its sensational nudity. It was never before attended in this way, but habitually was clad with its meaning the moment seen and rapidly passed from it to the other words of the phrase. In short, it was apprehended with a cloud of associates, and thus perceived, it was felt quite otherwise than as felt now alone.

Certainly illusions furnish evidence of the dependence of perception upon preceding experience. Typographical errors are overlooked by

the ordinary reader unless they are very serious because he sees what he is in the habit of seeing, and not what is really before him. The organization therefore of sensations exhibited in perception is reflected in a corresponding motor response organization. Both are subject to the general principle of habit.

Common phrases suggest that both time and space are perceived just as objects are perceived. Adjustments to surroundings occur in a medium of both time and space, and the effectiveness of reactions is largely conditioned by ability to make intelligent allowance for these factors. Vision, touch, and the kinaesthetic sensations have generally been considered as self-evident sources of space perception, while the other senses have been the subject of some controversy. In animal life the adjustment to space relations hinges very largely on the factor of direction, as the animal must go in the direction of food and in the opposite direction from its enemies. Another capacity is the ability to localize stimulations upon the bodily surfaces. Perception of distance and perception of shape and size are presumably somewhat later acquirements. In perception of direction, vision, touch, movement, hearing, and smell serve; the latter however gives only very crude impressions of direction.

Hearing conveys suggestions of many kinds of space relations, but its only real spacial function is the determination of direction, in which it is far superior to smell, but of course cannot compare with vision for delicacy of localization.

Visual space perception far surpasses any of the other senses. Its range is virtually unlimited. It detects direction instantly and accurately, and enables judging with great precision both size and shape of objects. Due to binocular vision a direct visual experience of solidity is obtained. Although most judgments of visual distance are probably influenced by factors of experience involving touch and movement, the eye has its own mechanism for detecting distance changes, that is, alterations in the muscular sensations of convergence and accommodation. The size and distinctness of the retinal image also gives a clue; the nearer the object the larger and more distinct is the image. If the size of the object is known the distance can be estimated, and vice versa. Accuracy varies with different conditions. Judging distance relations by light and shade effects is learned, as in contours of a hill. Objects at great distances tend to take on a bluish tinge.

When there is doubt or hesitancy to trust visual perceptions, there is inclination to accept the verdict of touch as the final index of reality. In ordinary daily life touch is simply one of a group of factors which

cooperate with one another to give the actual space world. Touch sense enables the immediate movement of a stimulated region, and no doubt it was designed for that purpose originally as it is of the greatest protective value. In addition to the power of localization, touch possesses also the capacity to report size and shape with reasonable accuracy. Touch, in connection with movement, gives three-dimensional experiences as when a ball is grasped in the hand. In speaking of the touch sense, temperature and pain sensations are included but have little value in the perception of space relations.

Motor sensations due to movement of the body give immediately only vague and crude space perceptions, but they are of the greatest importance in the exact use of all the other spacial senses. In the first place, kinaesthetic sensations are almost invariably connected with other sensations, and especially with the cutaneous group. The anatomical conditions which bring about this conjoint excitation of kinaesthetic with other sense stimulations are no doubt responsible for the fact that movement is largely employed as a measure of the other forms of spacial sensation. It is in terms of the effort required to pass from one point to another that one learns to give some precise content to such a distance as the mile. The basis of all these spacial experiences is in the contact sensations coming from the soles of the feet, in the visual sensations arising from the constantly changing point of view, and also from the sensations which come from joint and muscle. Upon the product of these several factors is finally placed the conventional label in terms of feet or yards or miles. The organic sensations other than those of the kinaesthetic group play no important part in general spacial orientation.

In the perception of time persons are indebted to hearing and movement primarily, although as in space perception, all the senses may contribute their little share. It is only the briefer time intervals which can be perceived directly; the longer intervals are in general judged indirectly by means of symbols such as clocks, calendars, etc. Bodily rhythms help serve the purpose. Hunger and the changes of light and temperature which mark the sun's daily course give some indications of time. Short time intervals can be judged quite accurately by means of hearing and movement; in fact, a series of rapidly succeeding sounds can be judged more accurately than a series of flashes of light. These direct time judgments are periodic, that is, a time interval is broken up into a series of "moments" which are real durations of time from a fraction to several seconds in length, and each is treated as a unit. In comparing one time interval with another, judge whether or not one of these units is longer or shorter

than another, or whether there are more or less of such units in a total interval. In perception of accent and rhythm use the judgment of these immediately sensed time intervals, but both duration and accent are involved. Hearing and movement are here also the most important senses but vision may be of importance.

28. Importance to pilot.—From the foregoing, the conclusion must be drawn that perception is of utmost significance to the airplane pilot. Although it would be impossible for him to do without any one of his other faculties, that of perception is absolutely essential. He must use his space-perceiving apparatus to the greatest degree almost continually. He must train his perceptive apparatus to a truly three-dimensional field. Here, indeed, must meaning be instantly and accurately given to sensory stimuli of all qualities and intensities on penalty of sudden death or injury.

In the process of learning to fly, the pilot must not only develop new meanings for old and familiar sensory stimuli, but he must also develop satisfactory meanings for entirely new and complex combinations of sensory stimuli. Old pilots make much of the term "feel of the seat." This would seem to be the resultant perception of many sensory factors, chiefly involving tactile, kinaesthetic, and the organic sensations. All of his perceptive equipment must be especially trained to the new conditions. He sees the ground below, and after enough experience perceives many things that are meaningless to one who makes his first airplane trip such as approximate altitude of the plane, character of the terrain, etc.

He must train himself to disregard many old familiar perceptions as unreliable in his new environment. He becomes the victim of many perceptive illusions and must learn to distinguish between the true and the false perceptions if he is to survive. When lost in fog his tactile, organic, and kinaesthetic sensations invariably give rise to false perceptions of position and orientation. He must then completely disregard them and trust entirely to his visual perceptions of the instrument panel if he is to get down safely. The actions of an old pilot when first attempting to fly "under the hood" amply illustrate the important part that meaning plays in transforming sensory stimuli into perceptions. The old pilot has developed a very strong set of meanings to certain stimuli through years of flying. These perceptions are probably preponderantly tactile, organic, and kinaesthetic combined with the spatial phase of visual perception. When learning to fly under the hood the sensory stimuli from the instruments must be given more meaning than heretofore, and as experience and time are necessary for this, he is at first tempted to trust to the

old familiar perceptions instead of the new ones. For this reason the belief of many that it is much easier to take a novice and train him to fly under the hood than it is to train an old pilot to fly that way may be quite true. In that case, it is easy to see what an important part meaning plays in accurate sense perception. The novice pilot, not having such a highly developed set of meanings for certain stimuli, finds it a much easier task to imbue with correct meaning the limited stimuli available to him under the hood. He can disregard completely the organic and kinaesthetic stimuli because they have no particular meaning to him anyway, and can concentrate on the instruments without the conflicts that the old pilot must experience. The new pilot's problem is that of learning, while that of the old pilot is unlearning as well as learning, and the things which he has learned the best are the very things which he must unlearn or disregard.

From the above discussion it will be concluded that in the field of aviation, the perceptive processes of man are taxed to their greatest extent, more so than in any other field. In aviation perception involves practically all the sensations except taste; extreme delicacy and discrimination are essential, correct interpretation demanded, sound reactions initiated with a maximum of speed, and extreme penalties are exacted for failure of the perceptive mechanisms.

SECTION VI

MEMORY

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29. General.—There is no sharp line of demarcation separating the mental events involved in memory and imagination. There is reasonable certainty that both have one point in common, that is, the image. The image is not only the basis of reproductive imagination which is involved in memory but is also the basis for productive imagination as well.

30. Definition.—There have been numerous definitions of memory, all of which express about the same meaning. James' definition is the one most frequently quoted: "Memory proper is the knowledge of an event or fact of which meantime we have not been thinking with the additional consciousness that we have thought or experienced it before."

In memory consciousness not only represents old experiences but also the ideas thus brought as actually standing for items of previous states of consciousness.

There is a distinction between the mere appearance or reappearance of ideas in consciousness and the fact of memory. Memory involves the recognition of these ideas as elements in the past history of the individual. All conscious memory is reproductive imagination, but not all reproductive imagination is memory.

31. Components.—Memory is assumed by most investigators to consist of four components, impression, retention, recall, and recognition.

a. Impression.—Just what change takes place in the various structures which are involved in memory is not a settled question. That a change does take place is accepted by all.

The extent of the field of consciousness must depend upon the number of neurones activated by a stimulus or a situation. The more complex the situation, the more intense and the more widespread the cortical activities will be. It is the summation of these cortical activities at any one time which constitutes the conscious individual. The group activity, the united activity of many neurones, gives rise to a community of consciousness, a sense of self as something distinct from the outside world.

The community of action of the cortical neurones must inevitably give rise to the function of memory. The individual is presented with a situation, the cortical neurones receive numerous impulses from the sensorium. The neurones assume relations with each other corresponding to the character, intensity, and other qualities of the stimuli received. If a similar series of impulses have been transmitted by the neurones before, similar or the same combinations will be reformed, and as a corollary there will follow a recognition by the neurones concerned in the communal relation of consciousness as something experienced before. The capacity for memory must depend upon the facility among the neurones for reforming old combinations. Perhaps some of the "instincts" or "race memories" have their basis in combination of such frequent recurrence in the ancestry that they have acquired all the potentiality of inherited structure. Activity of neurone combinations, that is, the passage through dendrites, cell, body, and axone, causes a change in the substance of the neurone. Definite groups of neurones therefore become associated in the transmission of impulses and passage through these groups is facilitated.

b. Retention.—The permanency of the changes occurring in the neurone patterns which have been activated depends a great deal upon the character of the stimulus, that is, whether it is logical or related to one's interests. Investigations of retention of associations bear largely upon the rate of disappearance of associations with time and the rate at which these associations are forgotten.

Retention may be considered as a quiescent state in which a learned reaction remains until the stimulus arrives that can arouse it again. In other words, the learned reaction retires to either the foreconscious or the unconscious and remains there until the stimulus with the requisite associative effect brings it to the surface of consciousness. However, the machinery developed in the process of learning is subject to the wasting effects of time and is less able to function as the period of rest increases until finally, perhaps, all retention of a once learned reaction may be lost. Another way of stating it is that the less often the learned percept is used, the fewer are the number and variety of associations formed for it. The more infrequently it is viewed in consciousness, the more firmly rooted it becomes in the unconscious. Therefore after a lapse of time it tends to be lost to consciousness and retained in the unconscious.

It is sometimes claimed that nothing once known is ever forgotten because of the fact that childhood experiences supposed to have been forgotten have sometimes been recalled after some effort or under hypnosis, or because persons in delirium have been known to speak a language learned as a child but since forgotten. This statement is extravagant; it is only a half truth, as will be explained. This would mean that all the names ever known could be recalled and all the scenes that ever attracted attention could be revived if the right means were taken to do it. In one sense, however, no item of life is ever literally and entirely forgotten; for even if it is found impossible to recall voluntarily a certain idea, it must be believed that the experience originally encountered has left its impression upon the psyche.

The curve of forgetting as evolved by one authority only partially holds good, and that only for barely learned material. Experiments have shown that during the first 24 hours between 20 and 40 percent of the material is lost and that at the end of 30 days only 76 percent is lost. In other words, less than four times the material will be lost in a period 30 times as long. These experiments were made with nonsensical syllables.

It will be seen that from the standpoint of economy of learning, the time to review a subject which has been partially learned is soon after it has been presented. Business houses use this principle in sending out follow-up letters, frequently at first, less often once the impression has been established.

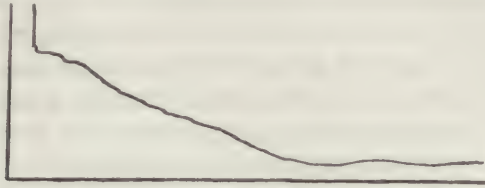


FIGURE 1.

The retention of an experience is but another name for the possibility of thinking it again, or the tendency to think it again with its past surroundings. Retentiveness depends upon the fundamental characteristic of the nervous system, its impressibility, which is not subject to improvement according to James. Thus the possibilities of memory are fixed by heredity although actual accomplishments within this limit will depend upon education and other factors.

c. Recall.—Recall always proceeds along the line of previously formed associations. Recall or reproduction depends upon the stimulus which calls up the association, and also upon the degree of success or pleasure connected with the association. James says: "We make search in our memory for a forgotten idea just as we rummage our house for a lost object. In both cases we visit what seems to us the probable neighborhood of that which we miss. We turn over the things under which, or alongside which, or within which it may possibly be, and if it lies near them it soon comes to view. The machinery of recall is the same as the machinery of association, which is nothing but the elementary law of habit in the nerve centers."

Some minds are like wax under a seal, no impression, however disconnected with others, is wiped out. Others like a jelly vibrate to every touch but under usual conditions retain no permanent conscious mark. These latter minds before they can recollect a fact must weave it into their permanent store of knowledge. They have no desultory memory. Those persons on the contrary who retain names, dates, addresses, anecdotes, gossip, poetry, and all sorts of miscellaneous facts without effort have desultory memories to a high degree, and certainly owe it to the unusual tenacity of their associa-

tive pathways. No one probably was ever effective on a voluminous scale without a high degree of this physiological retentiveness.

The more a fact is associated with other facts in the mind, the more firmly fixed it will become. Each of these associations becomes a hook to which it hangs, a means of fishing it up when sunk beneath the surface of consciousness into the depths of the unconscious. A secret of a good memory is thus the secret of forming diverse and multiple associations with every fact desired to retain and in using it at least moderately often. Of two men with the same outward experiences and the same amount of mere native tenacity, the one who thinks over his experiences most and weaves them into systematic relations with each other, will be the one with the best memory. Most men have a good memory for facts connected with their own pursuits. This is due to interest. The college athlete whose interest in books is purely secondary may astonish by his knowledge of men's records in various fields of athletics and be a walking dictionary of sporting statistics. The reason is that he is constantly going over these things in his mind, making comparisons, etc. They form for him not so many odd facts, but a concept of personal import, a system touching his own *amor propre*. Thus they stick and are easily brought to consciousness.

As things learned in a few hours of intense application cannot possibly have formed many associations with other things in the mind, the reason why cramming is such a poor way of acquiring material is readily apparent. On the contrary, if the same materials are taken in gradually day by day and considered in various relations to other concepts and reflected on, they more readily and easily tend to become permanent possessions of quick and easy recall because there are more association pathways open to a stimulus.

There are various factors interfering with the retention of material and its recall. One difficulty with recall is reproductive interference between different associations. A newer association because of the freshness and recency of its pathways is likely to get the start of an older association and thus govern the first response. By so doing it acquires even more of the advantage of recency so that a renewed attempt to arouse the old association may simply lead to the recent one again. This usually happens when the associations are very similar. It occurs in trying to recall a piece of music which resembles a piece just heard; it is hard to drive one out of the mind (consciousness) and to give the other a chance. Unless the right response occurs very soon, it appears to be short-circuited by

the false responses which occur and it is best to drop the subject until the interferences have died down.

Freud's theory of the interferences operative in recalling a familiar name and of the causes producing lapses and slips of various kinds is interesting. It is also true and is applicable to everyday life. Freud, however, says, "No psychologic theory has yet been able to account for the connection between the fundamental phenomena of remembering and forgetting." But certain facts have been established. Suppose a name has several associates that tend to be recalled with it. It may be that these associated ideas are unpleasant, or that they have been unpleasant at sometime in our past experience, or that they are not welcome at the particular moment. At any rate, there is a tendency to repress or to inhibit these undesired associates even before they actually break into consciousness. This is the unconscious innate tendency to protect from hurt, from the painful. When these undesired associates are repressed, the name is repressed as well, or by only partially repressing it a similar name is recalled. Furthermore, some of the associates may not be fully suppressed and may be operative in recalling a substitute name. In other words, a forgotten name points to a repressed complex of ideas and emotions. That which is thus repressed and suppressed from consciousness may be discovered by removing the suppression and allowing a train of perfectly free associations to take its start from the forgotten name when it has later been found. The name may be found by the free association method, and with it will appear the cause for that particular bit of forgetting. Old emotional repressions are lying at the bottom of apparently trivial lapses of memory. The emotional factor is the repression which blocks the word and prevents it from entering consciousness. The inability of recollection was for the purpose of protecting the conscious from the disagreeable emotion, the forgetting was a purposeful act of defense and was motivated by an unconscious wish to forget.

There is a certain selection by retentiveness of memory and also a selection for forgetting. All of the factors of this memory selection cannot be explained. There is undoubtedly an explanation somewhere, but it has not yet been discovered in all cases, even though the general rules have been defined. The following is fundamental and can always be proven true: forgetting according to Freud is always motivated by displeasure, and is founded on the pleasure-pain principle and is an escape from pain, annoyance of disparagement of self. It is the compromise of the conflict between

painful reality and the world as desired to be. This capacity for forgetting the disagreeable is naturally differently developed in different individuals.

When proper names are forgotten, this forgetting, or the substitution of one name for another, is due to a wish to disparage the person. It is either a conscious or an unconscious wish, due to personal jealousy, envy or some other cause. Mislaying of objects is nothing more than the result of unconscious intention. Freud cites from Brill the case of a man who was being forced by his wife to attend an evening party from which he would have much preferred to stay away. His dress clothes were in a trunk which he opened and into which he dropped the key, closing the lid upon it. This was done absentmindedly, with no memory of where the lost key was. Since the trunk had a spring lock and the opening of it necessitated a locksmith who was not available at that hour, he was obliged to remain at home, thus carrying out his desire after all.

Another common instance of an unconscious desire to forget is shown in the mislaying of letters. How many of us mislay a letter containing a check? And what an amazing faculty bills have for hiding in out-of-the-way places, and how easily their existence is forgotten!

Because of the fact that all unpleasant and painful memories, remorse, and the reproaches of conscience are not forgotten does not by any means necessarily denote unsoundness or cause the rejection of the Freudian axiom. No defensive mechanism invariably gains the upper hand. In the constant interplay of the psychic forces other factors may arise with associations so strong and so all-pervading as to stir up the contrary feeling and to overcome the defensive mechanisms.

The following aphorism from Nietzsche is amply illustrated by all daily:

"'I have done that,' says my Memory. 'I could not have done that,' says my Pride, and remains inexorable. Finally, my Memory yields."

Another factor associated with recall is perseveration. In certain abnormal conditions, a tendency is evidenced to repeat an act time after time when once it has been aroused by some appropriate stimulus. The response, once excited, persists and perseveres. This tendency is not confined to abnormal conditions, but has been demonstrated in normal subjects. It is most apt to lead to recall of recent experiences, and is most likely to appear when attention is relaxed and the mind is allowed to wander freely. Instances of

perseveration are found in the running of a tune in the head soon after it has been heard, or in the reminiscences of the day which are apt to come to mind when dropping off to sleep. The theoretical importance of these facts lies in the apparent absence of a stimulus to recall. The thoughts seem to spring up of themselves whenever the repressive force of other interests is removed, and for this reason some psychologists claim that perseveration does not come under the head of association but in a separate cause of recall. But search diligently enough, and the exciting stimulus can be found. Nothing in the physical world starts itself in motion without adequate cause. The same is true of the psychical world. There is a cause, an exciting stimulus, and it can be found. It may be either active or passive, active in that it is induced by some stimulus; passive in that it may be the conscious expression of repressed psychical effects when the censor is less alert and the repression is lessened. Therefore in the final analysis perseveration is an associative effect with a lessened control of the will.

d. Recognition.—If recall is the recovery of something from past experience, then recognition is the conscious reference of this recall to past experience and a knowledge of its value. Recognition is a form of learned response, depending on previous reaction to the object recognized. To recognize an object is to respond to it as before, except for the feeling of familiarity which could not occur the first time the object was seen. Though the object is the same, the setting may be different. Nevertheless, an appropriate response is made. Buy a paper from the same man each morning and respond to him in that setting that there is no feeling of strangeness. However, if seen in entirely different surroundings he will arouse that feeling of strangeness and yet he will be recognized. This is again a matter of associations.

Individuals are usually divided into four principal groups depending upon their learning ability as those who learn—

Slowly and retain well.

Slowly and forget quickly.

Quickly and forget quickly.

Quickly and retain well.

These last individuals are a rare but fortunate type.

In order that retention may persist, repetition must be made frequently before forgetting has progressed to the extent that a disproportionate repetition of the original effort is required to memorize. However, in the learning process the element of fatigue is extremely

important because constant and prolonged effort at committing facts to memory may vitiate the object sought. A short interruption may do more to assist ultimate retention than to attempt to carry on the memorizing process beyond the point where fatigue sets in.

Certain defects in memory are frequently noted, with the result that fallacious memory results even in normal individuals. This usually takes one of three forms:

Facts may be recalled in an order different from that in which they originally occurred.

Certain facts may be forgotten altogether, probably due to the fact that their importance was not particularly significant at the time.

Facts which never occurred will be inserted in the memory of those which did occur.

The partial destruction of memory is quite common after an accident in which a person is often unable to recall anything which occurred for a considerable time preceding and for appreciable intervals after the accident. The destruction may affect either a particular interval of time, some special group of subjects or the imagery connected with a particular sense. In senility likewise there is a marked and usually gradual disintegration of memory, noted especially for recent events, proper names, and concrete ideas, but the individuals recall vividly events of their childhood.

The process of forgetting, however, is quite different from the amnesia or loss of memory. It is really a very essential part of the process of effective memory that is necessary in order to free memories of the mass of trivial details of life. Usually what is recalled of an event or idea is a highly schematic and abbreviated recollection in which only the more important aspects present themselves. A certain clever and highly successful trial lawyer once stated that he did not bother to remember long involved statutes which change with each session of a legislature, or legal precedents on court decisions, but he did have an unusual ability to remember in what volume of the legal reports his information could be found so that he could obtain it when needed.

In fact, however, it is usually the material which will better enable to adjust to environment which will be most readily remembered.

In order to have a good memory, it is necessary for certain factors to be present. It is highly essential that there should be the greatest concentration of attention. Greatest concentration is given to those things which are emotionally exciting. The original impression can often be augmented by appealing to more than one sense as when a child is taught to speak a word, spell it out loud, and also copy it.

The association of one fact with other logically related facts is also an important factor in memorizing, while anything that tends to distraction will minimize the success of retention. The immediate practical application is also more serviceable in securing greater tenacity of the impressions as is evidenced in the applicatory method of training soldiers. As a general rule any systematically controlled discipline of attention seems likely to leave behind some positive benefit for intellectual work, and memory is no exception to the rule. Mnemonic systems are built upon the creation of a great variety of arbitrary associations such as the familiar method of medical students who learn the cranial nerves by recalling "Old Olympus' towering top."

32. Factor in training.—With reference to flying training everything that has been discussed here so briefly has a definite relationship to the success or failure of a student. Likewise it has a definite relationship to the success of the graduated flyer. Undoubtedly the applicant reporting for training who is in that rare and fortunate group that learns quickly and retains well will be the best qualified inherently. He will make a good flyer as well as anything else, provided other factors are favorable. The second possibility might be the class who learns slowly and retains well. This type will probably not make an unusual flyer but he will probably live the longest. However, he is under a great handicap from the start if he has an instructor who has not the patience to teach him.

With reference to the essential factors for retaining information, the best type of training would be that in which the greatest number of pathways are opened up during the instruction period. In flying however the speed with which the various maneuvers must be learned and coordinated is related definitely to the speed of the aircraft. An instructor should drill his students repeatedly on one phase before going to another so that the pathways for response become almost automatic, and so that the response of the pilot is almost reflex in nature rather than a memorized method of movements of stick, rudder, and throttle. In the event that a pilot depends upon his memorized movements to control an airplane, an unforeseen minor eventuality may leave him in a situation where the plane will fly him to the ground instead of his piloting it down in a forced landing.

Amnesia, especially that preceding and following an accident, is probably a boon to the flyer but a bane to a crash board. In a non-fatal accident it is probably best that a pilot does not remember the last few split seconds in which the earth is rapidly spiraling up to meet him. And certainly, even if he walks away from the crack-up

dazed and with no knowledge of what has happened, it is probably best that concussion perhaps has blotted out the emotions of fear and horror and the thoughts and memories of others who were not so lucky.

From the standpoint of the memory processes it is essential that as few persons as possible should visit a crash, that is, only those whose duties compel them to be there. The student who has seen the shapeless mass of what was once an aviator held together only by a flying suit and helmet that may be extricated from a mass of twisted wreckage is likely to recall it too vividly when his own plane goes into a stall or spin.

The best estimate of a candidate's memory is a careful history of his life from childhood to the present. Certain data as to ages, dates of birth, illnesses, marriages, births, and deaths in the family will give an index as to his memory of closely related personal events in his family. Occurrences and major events of recent history will give an index of his retentive ability to assimilate occasions within his own life span. A required description of a favorite teacher, associate or companion, or conversely, of some unpleasant occurrence, antagonism to a certain person or intolerable situation, will aid in determining his memory. Not only must the memory itself be determined but the memory of the emotional response to the memory.

33. Process.—*a.* Fundamentally, it is memories with their recall of past events which enable adjustments to a rapidly changing environment and it is the recognition that these facts have been experienced before which from the psychological standpoint is the salvation and gets individuals over the narrow and almost indistinct boundary between the normal and abnormal memory processes. The things, thoughts, or events which have been experienced before, that arouse pleasant emotions, and even those which, though unpleasant, have met the demands of adjustment with satisfaction, will be best retained and recalled as memories and perhaps pleasant ones, while those which have directly or even indirectly threatened adjustments or existence become painful ones.

Memories, if too unpleasant or too much out of harmony with the struggle for existence within the particular group or element of society to which belonging, may be suppressed either consciously or unconsciously, voluntarily or without volition. Thus they may become complexes but they are still memories, even though the neural pathways may be overgrown with the weeds of time, and obstructed by the fences of custom, and almost washed away by the storms of

existence. Thus these memories so suppressed become complexes because they are literally kicked out of active consciousness, but they are memories nevertheless, and will intrude themselves into consciousness if not into recognition by devious, if not by direct routes, and therefore the concept or unconscious memory may not be recognized when it appears in its changed form in consciousness. These suppressed, banished, or even buried memories, or concepts or complexes are still memories in the psychobiological sense, and may and often do return at the least expected time and raise such havoc with consciousness that from the standpoint of personality there is no longer ability to adjust to changing psychological if not physical environment. Under these conditions either a mild or a severe psychopath results.

b. The following summary from one authority cites some of the memory influences:

(1) Memory, considered as a process, governs the acquired conscious and unconscious habits of mind and body because the associative tones determine the types of reactions.

(2) Unconscious as well as conscious factors are involved, but the process may be wholly unconscious.

(3) Registration and conservation of stimuli are responsible for the formation of the unconscious as the storehouse of the mind. They are therefore responsible primarily for all unconscious processes other than those which are innate.

(4) To it may be referred the direct excitation of many unconscious manifestations of various kinds.

(5) Consciously or unconsciously it largely determines prejudices, superstitions, beliefs, points of view, attitudes of mind, habits.

(6) Upon it, to a very great extent, depend what may be called personality and character.

(7) It is often the unsuspected and unconscious secret of judgments, or sentiments and impulses.

(8) It is the process which induces dreams and furnishes the constructing material.

(9) It is the basis of many hypnotic phenomena. Its perversions largely determine the symptomatology of the psychoses and psycho-neuroses. It is largely responsible for the conscious conflicts which disrupt the human mind and result in various pathological states.

(10) Upon the utilization of the processes of memory modern psychotherapeutics, or the educational treatment of disease, is largely based.

SECTION VII

IMAGINATION

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34. General.—This discussion of imagination is largely a symposium of the views of several psychologists none of whom agree entirely, which is as expected, but the opinions expressed are nevertheless believed to be a cross section of the conceptions of the central process of imagination as held by the most prominent men in the field today. Their differences seem to border on quibbling over such questions as whether or not imagination comprises only imagination in the sense of something ideatized as absolutely new or as including also the processes of imagery in its various forms. For the purpose of discussion imagination will be considered as including not only imagery of things never before experienced as such but as including also images of the various experienced sensations. No attempt will be made to locate the dividing line between imagination, illusions, hallucinations, and various other psychiatric phenomena.

35. Definition.—Imagination has been variously defined, psychologists differing to some extent on just what imagination involves. It is considered by some as synonymous with imagery, by others it is given a very narrow meaning. It has been defined as follows: “* * * as the consciousness of an object of sensory experience with the additional consciousness that this object is not immediately present to the senses.” Contrast this definition with the views of Robinson who says: “Thought insofar as it represents objects and events which are beyond our personal experience is imagination.” He further considers it as: “ideation representing objects or events which have not in their imagined form or arrangement, been present in the actual experience of the imaginer,” but he agrees as do most others that the various elements in an act of imagination are traceable to experience. Angell defines imagination as: “the mental device by which we anticipate the future,” this viewpoint being much more restricted than that of many.

36. Imagery classified.—Theoretically there are as many kinds of imagery as there are sensations, visual, auditory, motor, temperature, pain, taste, touch, movement, sensations of internal organs, and to these may be added imagination, memory, anticipation, composite, general, recurrent, hypnagogic, dream, tied, habitual, eidetic and hallucinatory images, synesthesia and number forms. So in psychology "imagery" includes reproduced sensory experiences and combinations of experiences of every sort in contrast to the popular interpretations of image as something visual.

Psychologists were at one time of the opinion that different types of imagery were employed by different individuals as one person employed principally visual terms in thinking whereas another employed auditory or motor terms to the exclusion of others. It is now generally believed that the majority of people think in various kinds of imagery and are not predisposed to one type alone although there are no doubt exceptional cases where one type largely predominates as in the case of gifted musicians, painters, etc.

It is considered an advantage to think in as many types of imagery as possible and it should be the aim of schools to employ visual, auditory, and motor imagery in their various forms. That visual images predominate with auditory next is not questioned and in fact many deny the existence of other forms of imagery.

In this connection the viewpoint of Warren and Carmichael is worthy of consideration as it would seem to furnish an explanation of this as well as a reason for the use of imagery of any kind. They say the chief distinction between images and perceptions, when compared to actual experiences, is a difference in intensity. They give the examples of comparing the memory of a clap of thunder (auditory image) with the real thing or the image of a room (visual image) with the actual perception. Furthermore, while they admit the existence of images of systemic and motor experiences, they consider them usually as of not much importance for the reason that systemic and motor experiences can be easily aroused so that there is no need to imagine them. For example, when imagining getting angry a certain body attitude is assumed which arouses actual sensations of anger. External stimuli, however, cannot be so easily controlled, things cannot be seen or heard unless the objects are there to stimulate the senses. This lack is met by the development of imagery which supplements sensations.

That no mental copy can arise in the mind of any kind of sensation which has never been directly excited from without is empha-

sized by James and proven from observation on persons blind or deaf from birth. A person blind from birth never has or can have a visual image and likewise a person deaf from birth cannot form auditory images. Instances are on record however of persons blind after the age of 7 years who were able to form visual images throughout life. The motor type is very interesting though comparatively rare. James cites the case of a young man whose cataracts were removed, he was shown different geometric forms and he said he had not been able to form from them the idea of a square and a disc until he perceived a sensation of what he saw in the points of his fingers, as if he really touched the objects. This illustrates the well-known fact that in many instances it is possible to bring back in one form of imagery facts which originally were experienced through another form, such as bringing back in the form of words facts which were originally visually experienced.

37. Memory and imagination.—Imagination is most intimately tied up with memory. Both are often considered as subheadings under learning. Memory is usually by imagination. According to Robinson no sharp line exists between the two. He would differentiate them by calling those things which actually happened memory, and those which have not happened, imagination. Just how memory and imagination differ can best be illustrated by reviewing the steps in memory—impression, retention, revival or recall, and recognition. The first three are present in imagination but the fourth, that of recognition, marks off true memory from all other types of imagination for the reason that recognition involves the factors of “location” and “familiarity.” Location gives to memory a definite setting in time and in space while familiarity gives it a sense of realness with the feeling that it actually happened. Thus it may be realized how closely imagination is linked to memory and is one of the important processes upon which memory depends. To remember a thing there must be ability to form an image of it whether the image is visual, auditory, or otherwise, or as is usually the case, combinations of different types of images. Imagery is the medium of recall.

The imagination plays a vital part in memory, and in turn memory effects learning in that there could be no learning without memory. Since the memory process is so dependent on imagination the reason is seen for employing more than one type of imagery in teaching. A certain amount of a given lesson can be learned by listening to a lecture but most educators agree that if the important points are written down, the learning process will be made correspondingly easier. That one person learns more readily by reading, another by

listening, means that this particular type of imagery is preferred and it would seem only logical that combining different types would be desirable.

38. Dreams.—There are some people who claim not to be endowed with imagination, not able to form images of any type whatever. They will insist it is not possible for them to form a mental image for instance of the breakfast table or of an automobile accident; that they do not employ images in the process of memory, learning, or reasoning. These people, when educated sufficiently to enable them to put forth some explanation in lieu of imagination in recalling events, claim that they recall events by “pure thoughts” and that these thoughts have no imagery and no sensory or motor elements about them. That recall by “pure thought” can be a fact is doubted by the large majority of psychologists.

For the person who doubts the existence of images we may well have him turn to dreams where as Angell says, “many times the vividness of the experience seems to exceed that of the ordinary waking perceptions.” Dreams represent a product of imagination which has a minimum of conscious control but it is nevertheless imagination. Volumes have been written on dreams, their cause and significance. Most psychologists agree that dreams are at least in large part products of physical stimulation and there are many experiments to substantiate this view. Persons on having some cold object touched to the soles of their feet while asleep awaken having dreamed of walking in snow; the common experience of waking after having dreamed of a fire engine or church bells ringing only to find the alarm clock ringing, is another example.

Franz and Gordon take up the subject of dreams in relation to images at some length. They point out that “practically all dream accounts give plain evidence of sensory characteristics such as color, taste, smell, movement, touch and organic sensations; that dreams are often emotional” and in their opinion, “dream emotions are as real as in waking life, in that emotion as a felt experience is always subjective.”

Dreams are unchecked by attentive effort, they are uncriticized in the light of best knowledge and they are worthless as a contribution to life purposes. The lack of critical attitude, however, may be considered an advantage at times. The product of dreams may be more brilliant and fertile than anything in the waking state. One may dream the correct solution to a problem after failing to arrive at it in waking attempts. The common experience of going to sleep after some hours of reviewing or memorizing a lesson and awaken-

ing the following morning with memory much improved is difficult to explain except by dream images.

39. Reproductive and productive.—The most widely used classification of imagination is that into reproductive and productive. Reproductive imagination approximates memory while productive imagination approximates reason. The former merely revives perceptions without essential change, while the latter recombines former perceptions in new ways. Without the reproductive form the past would be forever gone beyond recall while without the productive type no plan could be made for the future. Taken in these two broad classes imagination is the chief means by which the past is remembered and by which the future is anticipated. Some authorities on the subject recognize only productive imagination saying that this is imagination itself while reproductive imagination is true memory.

Reproductive imagination, it is agreed, closely approximates memory in that it is the medium of recall but it is differentiated from memory as pointed out previously by the absence of recognition always present in memory. All verbatim memory involves reproductive imagination. This type may be concrete or symbolic as for example, when "chair" is thought of, the visual image of a chair itself, or of the spelled word, or an auditory image of the spoken word chair may be formed.

Productive imagination, often called constructive imagination or fancy, is in spite of the designation nevertheless made up entirely of returned sensory experiences, nothing being capable of existing in imagination unless it has actually been experienced. In this type of imagination, however, elements from two or more separate experiences are joined together. In imagining a six-legged horse images of legs and other attributes of experienced sight of a horse are merely put together and a six-legged horse which has never been seen is imagined. The inventor is dependent on this type of imagination to gain a mental image of his product before it is possible for him to construct it. In other words, the finished product is new but the materials used in its construction are not new. Thus many fancies are fantastic but they are always made up of former sensory experiences. Their combination does not necessarily represent a reality or even a possible reality.

Productive imagination is important in child psychology. The young child is a very imaginative creature. He lives in a world of imagination so to speak. The distinction between imagination and reality is not well-defined in the child, accounting for what many

times appear to be lies, but an understanding of the child's mental processes will show that there is no ethical significance to such lies. As the child grows older his imagination tends to become restricted and falls into grooves. Some become inventors, others reformers, others scientists, while still others may become daydreamers, self-contained inventors, reformers, and scientists, but only daydreamers nevertheless in that they cannot distinguish between their fancies and reality. Daydreaming has become excessive and reality disregarded. The imagination of such an individual is not unlike true dreaming in that it is not subject to the criticism of fact or reality.

Fancy exercised properly may be the instrument by which one is kept on the track to the attainment of a desired goal which cannot be reached immediately. Persistence in spite of many obstacles over a period of years would be difficult were the individual unable to visualize the ultimate goal and "imagine" himself to have reached it.

40. Other kinds of imagery.—In addition to imagination images and memory images synonymous with productive and reproductive imagination respectively, the other kinds of imagery mentioned earlier will be briefly described as taken in large part from Warren and Carmichael.

a. Anticipation.—Anticipation images are based on past experience in which the future is represented.

b. Composite or free.—Composite or free images are built up through frequent repetitions of substantially the same experience as, for example, the image of a friend's face includes both front and side views and the image of a certain house may include both inside and outside, although in neither case were both views ever perceived simultaneously.

c. General.—A general image is one due to the fusion of many similar images into a single experience. In our image of a horse the prominent elements in the general image are those details in which all horses agree.

d. Dream.—The characteristic of dream images is that they are mistaken for reality when they occur. In this way they are similar to hallucinatory images and are often classed with them. As pointed out before, daydreaming may reach the point where reality is disregarded and the image substituted in its place.

e. Hypnagogic.—Nothing need be said of hypnagogic images except that there are images which occur in the waking state often referred to as hypnagogic hallucinations.

f. Recurrent.—Recurrent are images which tend to recur with great persistence and may run in the mind for some time after the ac-

tual experience. Many find themselves repeatedly whistling a tune long after it has been heard. In an exaggerated case such images may be the basis for an obsession.

g. Tied.—The tied type includes those certain images which are seen as complete whereas they are not fully outlined.

h. Habitual.—Habitual are images which are characteristic of the individual such as visual, auditory, etc., and represent the type of image they prefer, although most persons have mixed imagery as previously noted.

i. Synesthesia.—Synesthesia phenomenon, although very properly considered under imagery, might also be described in connection with perception. When the ordinary person hears a word the perception is dominantly auditory, but for some few people the sounds produce a consciousness of color. This is known as synesthesia. They often resemble imagery in texture, are native, not acquired, and they are constant. The auditory-visual combination is the most frequent but other combinations may exist.

j. Number forms.—The number form is a graphic mental picture used by its possessor to exhibit numerical relations. Numbers are projected in a sort of visual frame and are always thought of in this way. Months of the year are often placed in this form. These number forms are natural phenomena and not invented or consciously adopted. They are used to render concrete something abstract and not easily memorized.

k. Eidetic.—This interesting phenomenon is quite completely described as follows: Certain people, from infancy to adolescence especially, are gifted with ability to look at some picture or other object for a fraction of a second and then project an image of it and describe it minutely from this image. In an experiment, certain subjects could project such an image of a row of numbers after a card on which these numbers appeared was passed before their eyes, with sufficient rapidity that all they saw was a dark streak. After projecting their eidetic image they could then call off the numbers in correct sequence with amazing accuracy, seeing some numbers easily and blank spaces between, and later fill in these spaces with an image of the correct number as it existed on the stimulus card.

41. Educational value.—As has been pointed out briefly before, the use of imagination is important in education and the learning process. This brings up the question of training imagination, a subject which baffles most investigators to a large extent, but all agree as to the value to be realized from a well-trained imagination. As noted previously, imagination is usually well-marked in the child;

also, that the majority of persons prefer a particular type of imagery and are able to exercise a greater control over one particular type than others. There is a distinct advantage however in the ability to use special kinds of imagery in the solution of particular kinds of problems and it can therefore be seen that it is of value to train the imagination in different types. Angell believes that voluntary attempt may achieve considerable development of specific types of imagery provided there is a reasonable body of it available to start with.

Pillsbury in a discussion on the process of imagination and the control thereof has this to say: "How can one imagine? * * * have a certain amount of knowledge and then let the operations go on as they will. Imagination is controlled through association and each link is suggested by the preceding one. But if you desire a new idea, it is well to look to some external stimulus to present it. Associative processes are constantly active, mental pictures occupy the entire waking life, but it is only now and again that the constructions are of value. A number of constructions appear but acceptance or rejection alone can be controlled—one cannot even think of a new thing at will—try to draw as many different figures as possible—all will show many of the same characteristics."

Colvin and Bagley in their work on "Human Behavior" give some interesting criteria to be used in training imagination. In earlier life imagination usually well-marked must be looked on as both an asset and a danger. Fancies should not be stimulated to the point where the child cannot distinguish between what imagination creates and what is fact. The fundamental principle to be used in determining how far the child should be allowed to go is that of behavior. Inasmuch as his images solve his problems satisfactorily they may be allowed to remain but the simple facts should be given him if necessary. In general it may be said that children who are unimaginative should be stimulated while those whose fancies are excessive should be held in check.

42. Flying applicants.—The consideration of imagination in connection with examination of applicants for flying training might be viewed from several angles. It is safe to say all possess imagination in some degree but what would be the optimum amount is most difficult to estimate even though there were some way in which to measure it.

In testing or measuring imagination one simple test enjoys considerable recognition, the painted cube test. The examinee is told to imagine a wooden cube painted on the sides and of a certain size,

varying from 3 to 7 inches on a side. He is then told to imagine this cube cut into smaller cubes 1 inch on a side. He is then asked how many cubes 1 inch on a side will be formed; how many of these will have paint on three sides, on two sides, on only one side, and how many will have paint on no sides. The one who gives correct answers to the questions is considered to be able to form a mental image of the problem and to possess at least normal visual imagination.

As noted previously, imagination is the basis for memory and both are important cogs in the process of learning. In regard to the learning required of the flying student in ground school there is already an excellent index to his aptitude for such type of work in his previous scholastic achievements.

In regard to actual flying a productive imagination is without doubt a valuable asset. In military aviation with intricate maneuvers the mastery of some of these would be next to impossible without the ability to form a mental picture of just what is desired by the instructor. Without a fair degree of reproductive imagination the student would not know when he had duplicated the maneuver an instructor had just demonstrated to him. It may be possible that the inability of some to achieve that very important but almost mythical thing called "feel of the ship" is due to lack of ability to form motion or kinaesthetic images which are present but very faint and not trained in most individuals.

The student flier is placed in entirely new surroundings in the ship. He has not the benefit of former experiences; he must be able to utilize the short experiences he does encounter during the first few hours of flying, and utilize them well or he will soon fall by the wayside.

In examining the applicant a fair insight into his personality is given by consideration of his imagination. The excessively imaginative individual if approaching the stage of the daydreamer would not be expected to do well. A too vivid imagination may be a factor in persistence of tenseness in flying. Imaginative processes certainly would seem to be an important factor in determining the degree of apprehensiveness in the student. It would seem that without further study on the question of imagination as applied to the applicant, it would be well to choose the middle path, preferring the trainee who is endowed with a sufficient amount of well-controlled imagination in preference to one who is either over or under imaginative.

SECTION VIII

LEARNING PROCESS

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43. Basis.—In a broad sense learning may be regarded as the modifications which result from experience. These may be very simple or extremely complex, the most complex being found only in man. These modifications serve the function of enabling the organism to make a better adjustment to its surroundings. To adapt well is to learn well. Wheeler says the term learning is used to denote the process of forming new connections in the nervous arc and perfecting such connections through repetition. It includes both the process of motor habit formation and the acquisition of central habits. When the multiplication table is memorized or to think logically is learned, the acquisition is central rather than motor.

Learning in its broadest sense includes modifications in the inanimate as well as the animate kingdom. The difference is one of degree rather than one of kind. But since there is so much greater modifiability in animals and since particular concern is with animals, use of the term will be restricted to this narrower field.

The possibilities of modifiability are largely in the nervous system. There may be some modification in the muscles as a result of learning, but the greater part takes place in the nervous system. Various theories have been proposed to account for the changes that occur in habit formation. The most generally accepted theory is that a change takes place in the synapse. In responses of the learned type the resistance is relatively lower than it is in other pathways. As a

result of practice, however, other synaptic resistances may be lowered so that they, too, become regular pathways. The lowering of synaptic resistances is possible because of the modifiability and retentivity of the nervous system. Modifiability and the property of retention are the two significant characteristics of the nervous system which form the basis for all learning and habit formation.

Learning differs from an innate response in that an innate response is ready to function without previous experience, while in learning, the neural pathway must be made more pervious as a result of practice. All animals are born with certain innate capacities for response. In the lowest forms of animal life these innate capacities are about the only ones the animal has. By this is meant that the animal never learns many new forms of behavior beyond those with which it is born. For example, the amoeba will seek neutral temperatures and places where light is not too strong. It will approach, when in need of food, certain substances. But the amoeba could never be taught to avoid a certain kind of substance without first approaching it each time. In contrast with the amoeba a chick will soon learn to avoid certain kinds of caterpillars which are not edible. After a few unfortunate experiences with such caterpillars, the chick will go about feeding, never pecking at the disagreeable worms. The chick has learned to reject certain substances of food, and also the desirability of certain other substances as foods.

As an example of a complex native trait the behavior of a bee may be considered. Wonderful stories are told of the organization of a hive of bees. Each worker has certain tasks to perform. Some are water carriers, others are gatherers of honey or wax, some act as servants for the queen, and others as a bodyguard for the hive. If we follow any bee during its activities, we will find that its behavior is very complex. It responds to certain kinds of stimuli positively, to other types negatively, and to some types not at all. For example, in gathering honey a bee will go to flowers which are rich in nectar, it will avoid certain poisonous flowers, and other plants it will ignore. Likewise, the bees that build the comb react to the substance to which the comb is to be attached by making the comb conform to the size and shape of the cavity to be filled. Reactions of this kind may be considered adaptations. Yet the bee today, so far as our evidence goes, builds its comb just as bees did in the time of Pharaoh. Furthermore, young bees seemingly build just about as good combs as old bees; that is, the young bees do not have to learn how to build a comb.

Besides adapting itself to the place where the comb is to be built, the bee must also adapt itself to the water and food supply of the vicinity. These adaptations may reasonably be considered as learning. Then learning may be defined as some modifications in the behavior of an organism as a result of experience which is retained for at least a certain period of time by the organism.

It is this degree of adaptability which differentiates the higher from the lower organisms. If the environment of one of the lower organisms is changed greatly, the organism is unable to meet the change and will die. In higher organisms if such a change occurs, the animal will either move to another situation or change the conditions. For example, if the temperature conditions of an amoeba change too rapidly or too frequently the amoeba will die. In a similar situation a man will build a shelter, put out the fire, or move to another climate. Man's versatility is his salvation.

Inherited or innate behavior therefore forms the basis for all learning.

44. Kinds.—The five ways in which original nature is modified are substitute stimulus, substitute response, negative adaptation, combination, and fixation of random movements.

a. Substitute stimulus.—In this type of learning one stimulus is substituted for another. The experiment of teaching the dog to respond to the ringing of a bell by an increase in the flow of saliva is a good example of learning by substitute stimulus. Learning to talk is a matter of substituting certain sounds for the object. When a cat comes into a room with a small child, the mother begins to say "kitty, kitty." When the cat has gone out of the room, the mother can say "kitty, kitty" and produce the same response in the child as the cat did. The spoken word has been substituted for the animal itself. When the child goes to school, he is confronted with the problem of learning to substitute certain printed symbols for his spoken words. The teacher prints the word kitty on the blackboard or shows it to him in a book and tells him this is kitty. He must learn these visual symbols as substitutes for his vocal symbols.

The principle of the substitute stimulus has many practical applications. Commercial companies capitalize on the use of substitute stimuli. Slogans, trade names, and patented signatures are devices for indirectly suggesting responses. They are substitute stimuli standing for the real article. In some cases a word comes to stand for a whole class of articles. The word kodak not only stands for the small camera made by one company, but also for all small cameras.

b. Substitute response.—It happens that in some cases the present connection between stimulus and response does not produce the most desirable reaction. Other responses may be made which are found to be more satisfactory. These responses are then connected with the stimulus as a substitute response. In boxing, for example, the normal thing to do when a fist is seen rapidly approaching the face is to shut the eyes and dodge. But a boxer soon discovers that this is not a very effective type of response. He soon finds that it is more efficient to put the hands up for a defense, block the blow with the hand, keep the eyes open, and return the blow. Keeping the eyes open is substituted for closing the eyes, and a guard position for the hand is substituted or added for the dodging. Correct positions and reactions, in athletics and all skilled activities, especially flying planes, are generally substituted responses.

c. Negative adaptation.—The elimination of unsuccessful, wrong, or fruitless activity is as much a part of learning as the formation of successful responses. Such elimination is also a form of substitute response. A worker in a factory may at first become quite nervous from the continuous noise of the machinery. Later he may become negatively adapted to the noise and it will not bother him. The doctor learns to look for certain significant signs of diseases. All the hundred and one normal bodily functions he must learn to neglect when he is looking for disease. An airplane pilot before he becomes well versed in the art of instrument flying will hesitate to bank the plane in a certain direction to straighten it out, while at the same time he has sensations of already turning in that direction and the seemingly correct thing to do would be to bank it in the opposite direction. After he learns more about it he pays little or no attention to these sensations of turning, but takes heed of the stimuli arising from his instruments. He becomes negatively adapted to the sensations of turning.

d. Combination.—Another form of modification of responses or type of learning is by combination of responses. Complex acts are made up of simple acts. This combination may be a parallel combination or a serial combination, but more commonly it is both. The parts which are combined may be either innate responses or responses learned by any of the methods already described.

All skilled acts are the result of combination. The problem of combination is not only one of the selection of the parts which are to be combined into the larger movement, but also of how they are to be combined. The serial arrangement of the parts is very significant. It is just as important that any part of the act is performed at the

right time and with the proper emphasis as that it is performed at all. The serial order of the maneuvers necessary in taking a plane off the ground is important. It is just as serious to do the right thing at the wrong time as it is to do the wrong thing at the right time. Playing a pipe organ is a good example of combination. Those who have never played a pipe organ can only marvel at the intricate movements which are made in playing. Often one hand is playing on one manual of keys while the other is playing another manual, and all the time the feet are playing the bass notes. At intervals one hand or the other must quickly manipulate the stops. This must all be done at a certain tempo and rhythm, as well as with the right touch to the keys.

e. Fixation of random movements.—Yet another method by which new responses are acquired is through fixation of random movements. A random movement is one which is made not as a specific response to a definite stimulus, but rather as a response to a general stimulation. A bright object may be presented to a baby. This produces a stimulation, but he has no ready made type of response. Instead of making the specific response of reaching, the baby kicks, squirms, and frantically waves his hands. These movements are not direct responses, or at least they do not appear as such to the observer. They are what psychologists choose to call random movements.

Some random movements produce a result which is agreeable to the baby as, for instance, he may accidentally touch the bright object. This gives him pleasure. The next time it is held before him, random movements again occur. But the results of the earlier success tend to make the pathway which produced the earlier success more permeable. Therefore there is a greater tendency for the nervous current to pass over this pathway than over the others. This difference in resistance is not great for the first few trials, but as more and more responses are made, the course along the given pathway tends to become more deeply seated. The result, the immediate touching of the bright object, is a learned type of response. In this manner many random responses become fixed into useful acts.

45. Laws.—Having accounted for the ways in which new types of reactions are acquired, the problem still remains of how these new forms of behavior are fixated into routine acts. A few simple laws which account for this fixation process are use, disuse, effect, primacy, recency, and vividness. The first three are called primary laws and the last three secondary laws.

a. Primary.—(1) *Use (or modification by exercise).*—The law of use may be stated as follows: Of two neural pathways, other things

being equal, the one which has functioned most often will be most ready to function again. Or, as Gates puts it, whenever a modifiable connection between a situation and a response is exercised, other things being equal, the strength of that connection is increased.

The law of use expresses a basic fact, one that is needed to explain learning of every kind. A necessary correlate of this law is the fact that exercise up to a certain physiological limit is cumulative in effect. If one response strengthens the connection somewhat, then two responses have greater effect than one, three greater than two, etc. Consequently, other things being equal, the more frequently a connection has been exercised the stronger the connection. This is sometimes called the law of frequency.

(2) *Disuse*.—The law of disuse is really the reciprocal of use. Other things being equal, a neural pathway which has not functioned for sometime offers more resistance than one which has functioned more recently. Or, as Gates puts it, when a modifiable connection between a situation and a response is not exercised during a length of time, the strength of the connection is decreased. Gradual forgetting of names, dates, poetry, gradual loss of skill in typewriting, drawing, singing, etc., when these functions are not revived by exercise, illustrate this fact. Motor learning such as typing is retained longer than most types of verbal learning.

(3) *Effect*.—Individuals tend to repeat those reactions which on the whole are satisfying, whereas they tend to avoid and therefore fail to repeat those reactions which on the whole are annoying. The child who likes arithmetic or piano playing, other things being equal, learns most rapidly. The child learns slowly who has to be driven to practice each day. The same thing holds for adults. The woman who does not like to cook is likely not to make a good cook if she can find something else to do which she prefers. She will get a job and hire a cook.

A child who has been frightened once by a dog may always be afraid of dogs. The effect of the one experience teaches the child to fear dogs. A person's like or dislike for another person generally depends upon some memory or experience in connection with the first meeting. These examples illustrate that one experience may have a profound effect in the learning process, an effect that cannot be explained on the basis of the law of use alone.

b. Secondary.—(1) *Primacy*.—First experiences are more likely to be retained than later ones. This holds whether one is learning a list of nonsense syllables, a poem, or facts in an outline. The first item has a better chance of being retained than others in the body of the

material. In a broader sense, an experience of childhood, other things being equal, has a better chance of being remembered than an adult experience.

(2) *Recency*.—Recent experiences are more likely to be retained than remote ones. This seems to contradict the principle of primacy, but they are supplementary rather than contradictory. Memory of the first airplane ride will more likely be retained than that of subsequent rides. Also, the last one will be remembered more clearly than intermediate ones. One day of disuse causes some loss in the strength of a connection, two days a little more, etc. The effect is cumulative. Other things being equal, the more recent the exercise, the stronger the connection between the situation and response.

(3) *Vividness*.—Other things being equal, a vivid experience is more likely to be retained than one which is less vivid. A person may remember a train or automobile wreck which occurred sometime ago as though it happened but yesterday.

46. Complexity.—Because learning covers so wide a range from the simple forms to the complex ones of adult human learning, it may appear that the simple and complex forms are quite different in their essential nature. As a matter of fact, all forms depend essentially upon a permanent change in the nervous system through experience. Classified according to complexity, the four types of learning are trial and error, observation, association, and ideational.

a. Trial and error.—Trial and error is the simplest type of learning, so characteristic of the lower animals. This type appears in the learning of children as well as in some forms of adult, and is much more common than at first might appear. This trial and error method is often good in the beginning of a task (it is certainly better than never attempting anything), but in human life it should be superseded as soon as possible by other more efficient types of learning.

b. Observation.—In learning by observation there is some insight into the method of procedure before the act is begun. Language is largely acquired by this method. Coaches in athletics, teachers of vocal and instrumental music, parents, as well as flying instructors, spend much time illustrating how to perform skilled acts. The benefit which the pupil gets from this instruction may be said to be gained through imitation. Imitation then is a form of learning.

c. Association.—In the two previous methods of learning there was a fairly direct connection between stimulus and a response; that is, the emphasis was upon the motor element in the learning. In associational learning there is a greater elaboration of complex cen-

tral connections and the motor component is usually confined to one type of expression, words. This type of learning is most effective when employed with connections which involve verbal reactions. By this method the child connects the names of objects with the objects themselves. Foreign languages are also learned by association.

d. Ideational.—In ideational learning there is still greater elaboration of the central processes. For example, a person faced with a problem may manifest few or no specific responses for a long time, but during this interval there may be great neural activity with only incipient or minor motor reactions. Mental multiplication of two numbers (29×36 , for example) is an illustration of this type of learning. An individual must learn a great deal about figures before he is able to do work in mental arithmetic. By a combination of trial and error, instruction, and associational learning he acquires the ability to add and subtract, multiply and divide. Finally, there comes the transition of all his learning from the motor side to the ideational side, and he is able to manipulate the symbols without referring to objects. He begins by adding and subtracting cards and blocks, is promoted to the stage where he adds and subtracts on his fingers, and finally learns to add and subtract numbers in his head. The transition is sometimes difficult, as is evidenced by children using their fingers below their desks when the teacher is insisting that they use their heads and not their fingers.

Ideational learning forms the largest component of the process of thinking. Thinking is literally delaying a response until various possible solutions have been tentatively tried in imagination, with probably certain minor movements accompanying this imagination and a final motor response to test the validity of the conclusion reached by this lengthy central process.

47. Effect of interest or motivation.—The attitude of the learner toward his problem makes a great deal of difference in the success of his learning. With sufficient interest in improvement, progress is sure to follow. By this it is not meant that anyone can become anything that he wishes. All have limitations and these differ from one individual to another. Very few, if any, reach the physiological limit. Many industries have discovered that even a slight increase in salary or improved working conditions have produced a decided improvement in work.

48. Effort facilitation.—It is common knowledge that individuals can learn more when they try. When alert, sense organs are ready to receive impressions, motor organs are ready to respond, and

neural connections are more ready to function. Effort is generally closely related to interest. In order to bolster up both interest and effort, a habit should be formed of doing anything whatever with all the might. Work when working and when playing play with equal energy. All are prone to be satisfied too easily.

49. Length of work period.—There are two parts to this problem. One concerns the length of working hours during the day and week, and the other distribution of work and rest periods during the day. Industrialists have found that manual workers as well as office workers can do considerable more work on an 8-hour day and $5\frac{1}{2}$ -day week than they formerly did working much longer hours and 6 days a week. Of course there is a limit to the amount of reduction in the hours of work. Too much leisure is not necessary or advisable.

Also, too much time spent doing one task is detrimental to efficiency. The time allowed for most tasks for maximum efficiency depends upon the individual and on the nature of the task. One authority found 30 minutes to be the best period for adults in the rather difficult task of substituting abstract symbols for letters in words.

There are probably individual differences in periods of maximum efficiency and distribution of periods. The problem is closely related to that of fatigue. Each person has the problem of discovering his best method of work for each type of task. A word of caution is necessary; a first feeling of fatigue, especially with routine work, is not a sure index of a reduction in efficiency.

50. Teacher as a factor.—There is a good deal of discussion about self-education in the course of which the teacher is often discredited and his place in the educational scheme discounted. It is true that education is an active process and that the student must do the learning; yet there is a real place in the educational system for the teacher. The best products of education generally come from the schools with the best teachers. At best self-education is wasteful and at worst it is likely to give wrong methods and results. It is just as easy to instruct too much as not enough. More instruction should come at the beginning of the learning and a small amount should be given as learning progresses.

51. Practice.—Some of the earlier psychologists contended that training was general and transferred from one subject to another. This doctrine is known as transfer of training. According to this theory, learning to operate a typewriter should help one when he attempts to learn telegraphy or to play a piano. Playing tennis should make one a better football player or a faster swimmer.

Driving a car should help in learning to fly a plane. In these fields there is probably some transfer, for exercise of the fingers or limbs in one activity should make them more agile in any other type of activity.

This doctrine, however, went farther and contended that any kind of learning or training would help in totally irrelevant fields. It was applied most vigorously to academic subjects, and its advocates held that a study of Latin, Greek, and mathematics would make one a better typist, a more skilled mechanic, a better physician or business man.

Within the last 20 years many experiments have been conducted to throw light upon this problem. Some of these showed a great deal of transfer and others little. Some showed negative transfer; that is, practice in one task actually hindered work in another. While there is diversity in the results, it may be summarized by saying that the nearer two things are alike, the more transfer there will be. If the two were identical, theoretically there would be 100 percent transfer. If they were completely unlike there would be no transfer.

The best way to learn anything is to practice it, not something similar to it. Sorting cards has been found to improve slightly the ability in typing, but if it is desired to learn typing, it is better to practice typing than sorting cards.

Learning may progress to such a degree that the resultant behavior will be almost as automatic, precise, and instantaneous as a reflex. These fixed behavior patterns which have been learned are called habits, and may range all the way from simple motor responses to such complex attitudes as hatred, laziness, patriotism, or philosophy of life. Habits have the advantage of simplifying many phases of lives, but at the same time they have the disadvantage of virtual enslavement to types of behavior which may be socially undesirable. By following certain rules one may control his habits and even free himself from unfortunate ones.

52. Learning information is acquiring reactions.—It is of utmost importance to realize that the acquisition of information or learning any fact is as definitely the result of one's reaction as is learning any motor act or skill. Unfortunately it is frequently assumed that facts are learned and ideas acquired as the result of passive absorption. It often appears that what is observed is what the environment impresses; and that ideas just come of their own initiative. The fact is however that in observing a thing or event, or in acquiring a fact about a situation reaction is just as definite as in tackling or avoiding an opposing football player. In learning to

recognize a football player before the game, one learns reactions just as definitely as one learns in practice to react by vigorous dodges and "straight arms" to the player's tackle. Finally, there are as many different forms of reacting which result in mere recognition of "Right Tackle Bill Jones" as there are types of evading Bill Jones' tackle. Different people learn different things because they react in different ways to different items, but without reaction nothing is learned.

53. Rate of learning vs. rate of forgetting.—Contrary to popular opinion the person who learns rapidly is usually the one who remembers the most material. Several reasons for this are—

a. The rapid learner is one who employs the better methods which work for a more thorough mastery of the material.

b. He learns faster with greater insight into the task. Moreover, the more insight he brings to bear upon the material the greater amount of it he remembers.

c. He apprehends more detail which gives him an opportunity to perceive the material in a greater variety of relationships. In case of nonsense material, where there is less opportunity for the apprehension of relationships, the slow learner who spends more time establishing relationships between details forgets less than the rapid and superficial learner.

54. Whole vs. parts method.—Other things being equal, it is easier to learn memorial material by studying it as a whole than by dividing it into parts and learning each part separately. First, when individuals attack a poem, for example, they proceed to memorize the first stanza then the second, etc. They find in this method an illusory evidence of progress at the outset, but they forget that after they have learned all the stanzas in this fashion they still face the task of putting them together, a procedure which requires a great amount of time in repeating over again the material learned as isolated units. Second, they waste time as they go along by missing the thread of the story. Had they availed themselves of this continuity it would have helped considerably. As it was they denied themselves the possibility of seeing the material in its wider relationships. Third, they are likely to learn separate sections with a distorted contention of their relative importance. This follows from missing the continuity of the whole. As a result, they may confuse the order of the material, follow wrong cues and perhaps leave out sections entirely when time comes for the recall. Many experiments have been carried out to confirm this. On the other hand, certain experimenters have found that the whole method is not as good as the part method when learning unfamiliar material.

We must distinguish, evidently, between relatively meaningful and relatively meaningless tasks. The whole method seems clearly to be less adapted for unfamiliar and meaningless tasks because the subject matter as such cannot be apprehended as a whole due to its lack of unity. Under these conditions the learner must respond to various parts as wholes by the part method or some modification of it. The student then must rely upon an apprehension of the less meaningful relationships between the learned parts such as the spatial and temporal before learning the task as a whole. There is nothing lost in this procedure because there are no part-whole relationships to be missed; there is something to be gained because otherwise the individual would waste time trying to grasp the material as a whole when there was no meaningful whole to be grasped.

55. Summary.—*a.* Inherited or innate behavior, or tendencies, form the basis for all learning.

b. Learning whether of motor acts or of facts is the result of reactions in the nervous system. It is believed that these reactions take place in the synapse.

c. Original nature is modified by substitute stimulus, substitute response, negative adaptation, combination, and fixation of random movements.

d. There are certain laws which account for the fixation of learning in the mind. The primary laws are those of use, disuse, and effect. The secondary laws are those of primacy, recency, and vividness.

e. There are four types of learning. Classified according to their complexity, they are—

- (1) Trial and error.
- (2) Observation.
- (3) Association.
- (4) Ideational.

f. A few of the more important methods for securing economy in learning are—

- (1) Interest or proper motive aids greatly the act of learning.
- (2) Increased effort facilitates learning.
- (3) Too long at the task or too long at the same task is detrimental to efficiency in learning.
- (4) The teacher is an aiding factor, especially at the beginning of a task; however, there can be too much instruction.
- (5) Learn by practicing the lesson to be learned rather than something similar to it.

g. As a general rule, the person who learns rapidly is usually the one who remembers the most material.

h. Other things being equal, it is easier to learn or memorize material by studying it as a whole than by dividing it into parts and learning each part separately. An exception to this is when learning unfamiliar and meaningless material.

56. Factors in aviation applicants.—In the selection of applicants for aviation training it is well to consider the following factors in relation to the learning process in determining the applicant's "flight" adaptability:

a. In what ways ability to learn new tasks, such as educational accomplishments has been demonstrated.

b. Power of observation and how well utilized.

c. Versatility.

d. How he applies himself when confronted with a new learning task.

e. Athletic accomplishments or other things that may demonstrate agility.

f. Interest in aviation.

SECTION IX

EMOTION

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57. General.—Through the history of the ages the emotions are found playing a major part in the destinies of men and nations. These emotions have played in fast and furious actions and in slow deliberations. Cleopatra stirred the Roman leaders to their depths, causing them to make foolish decisions and working their own downfalls through their impetuosity. That master tactician, Napoleon, pondered on his great battles, ever planning new conquests, and all the time fired by ambition until he lost all sense of proportion and was downed by that very trait which made him what he was. Back of all this was what is called emotion.

58. Definition.—What is emotion? Men for years have been striving to answer that question and though they have put into words many theories, they have still a long way to travel before they obtain that concrete description which science demands. These theories contain logic, the reasoning of years, but still are far from their goal. The theories are always tainted with the personal emotions of those who formulate them. In spite of attempts to correlate the material into one theme the psychologists hold to their master theories and revolve about them, criticizing, battering at those which do not lead or follow them in their own beliefs, but most always failing to offer new theories which might be steps toward the formulation of a better theory, the answer to the problem in a hybrid of all theories.

59. Theories.—In all literature there seems to have been no concrete theories of much note until the contemporary theories of James and Lange in the latter part of the nineteenth century which have come to be known as the James-Lange theory. The Greeks led by Aristotle and the Romans were thinking along the lines expressed in this theory, and Malabranche practically anticipated it when he emphasized so effectively contractions and dilations. But throughout the eighteenth century these remained but barren theories, representing the futility of all attempts to reduce experience to the language of mechanics.

Because it is plausible and widely accepted, the James-Lange theory will be used as a basis for the discussion of this subject. It may be stated in these few words of James: "Bodily changes follow directly the perception of the exciting fact, and our feeling of the same changes as they occur is the emotion." He further states "the movements of the body, when felt are the emotion, and the mental factors are altogether subordinate." James claims that one is sad because of weeping, instead of weeping because of sadness. In a great many cases the emotion appears only after the bodily changes have been felt. One may face a situation with no great appreciation of its danger, or even with knowledge that there is no danger, and suddenly become aware of a trembling of the limbs together with a sinking feeling in the abdomen. With these bodily reactions the emotion of fear is fully established. This is seen in the case of a person who stands at the brink of a precipice at first unafraid, but suddenly he is seized with dizziness and trembling, and he withdraws from the edge in fearful haste. He is afraid. What has happened to so shatter his confidence and destroy the feeling of security which he possessed when he first stepped to the edge? Perhaps as he looked down he perceived the great height and subconsciously reflected upon

the possibility of a fall. This perception became the stimulus which must precede the sensations from the organs. The emotion follows. A blindfolded person has no such fear. He can be led to the edge of a building and without fear walk off of it if someone does not stop him. He has received no stimulus from perception and therefore no bodily reactions are initiated.

Memory may enter this picture, inasmuch as the perception of heights may lead to the subconscious recall of a fall, and this act as the stimulus.

Instinct also enters these pictures of emotion and throughout literature are references to the caged and uncaged animal. In the first case there is no fear because no bodily changes result from the contemplation of a lion within a cage. The old comedy sketch of the braggard who avers he is not afraid of a lion is another good example. He brags about his prowess at lion hunting and approaches the cage unafraid. Suddenly he perceives that the lion is not in the cage but has somehow escaped and is free. The startled expression of the face, the perspiring brow, the trembling knees, all precede the acute emotion of fear. What has happened? Did the sight of the liberated lion cause the body reactions, the result of which he is afraid; or did he perceive the predicament he was in, become frightened, and then give way to the body reactions? The James-Lange theory holds to the former view, and all the ensuing 50-odd years have not brought forth a theory to replace it.

Other theories have been propounded. Some of these attempt to explain further this same idea, others have supported it, and still others have tried to replace it. Try as one will it is almost impossible to get away from the basic idea, and experiments have tended to strengthen this theory.

One author in writing on "Bodily Changes in Pain, Hunger, Fear, and Rage," has shown the internal bodily responses to be in the form of an increased output of adrenalin and glycogen, the results of which are seen in the picture of pallor, trembling, a feeling of cold or heat, quickening of the pulse, and other phenomena.

McDougall sees in the emotions the expression of primal instincts. His views lay the initial response at the door of instinctive reactions to a predicament, the result of which leads to the bodily sensations recognized as emotion. The nature of the emotion is dependent upon the predicament and the instinctive response it evokes. The emotion is merely the conscious side of the instinct.

60. Nervous system involvement.—*a. Autonomic.*—(1) Glands and smooth muscles are thrown into action by neurones which form

links between the smooth muscles or the glands and certain ganglia located in the body but outside of the central nervous system. The neurones are connected at these ganglia by synapses with motor neurons which come from the central nervous system. This part of the nervous system containing these ganglia is called the autonomic division. There is a physiological antagonism between the sympathetic and cranio-sacral portions of this division. Though these two portions innervate the same organs, they produce in them opposite reactions. Though the autonomic division possesses a degree of independence, it is not to be thought of as separate from the central nervous system. It is connected with it by synapses and can be affected by nerve impulses from above.

(2) The autonomic system is divided into three neurone groups as follows:

(a) Cranial division which is connected by ganglia with the upper part of the cord and midbrain.

(b) Sacral division which is connected with the lower part of the cord.

(c) Sympathetic division which is connected with the intermediate portion of the cord.

The sacral and cranial portions are anatomically distinct but they have a similar function which is antagonistic to the function of the sympathetic portion. The internal organs, glands, and superficial smooth muscles are supplied with neurons from the sympathetic part on one hand or from either the cranial or sacral on the other. The opposing actions are seen in the stimulation of the heart by the sympathetic portions and the inhibition of the heart's activity by the cranial portion.

In general the cranial division stimulates the muscular and glandular parts of the intestines in the upper abdomen, while the sacral affects those of the lower abdomen in a similar manner. The sympathetic portion inhibits all these organs. If the cranio-sacral stimulates, the sympathetic inhibits, and vice versa. They are antagonistic. It may be further stated that the unpleasant, intense emotions of fear, anger, and bodily pain occur during activity of the sympathetic portion while the pleasant emotions of digestion and sex behavior are active when the cranio-sacral is in control.

The sympathetic division tends to act as a unit, but the cranio-sacral does not invariably do so, and there are typical responses which are stronger in some organs than in others.

(3) While the autonomic system can and does act independently of the central nervous system, it may be affected by impulses from

the higher system. It is by means of these impulses that such things as noise, blows, and objects can cause a quickening pulse, a slowed or accelerated respiration, etc. Such external stimuli may alter the activities of the internal organs such as glands and smooth muscles. These alterations in activity may be slight or profound. They may be due to original external stimuli or to impulses from the central nervous system which are initiated by memory of past experience.

b. Central.—The central nervous system may receive impulses from the autonomic system, and it is in this manner that the sinking sensation in the abdomen, the flush of guilt or embarrassment, the chill which plays up and down the spine, etc., are felt. All these play an active part in the recognition of the emotion as such and help to differentiate the kind of emotion felt.

According to many writers, if the proper response is made to a predicament, there will be no emotion. This is explained on the basis that the sudden charge of potential is used up in action before it can cause the bodily changes which call forth the emotion. This would explain the situations of danger in which no emotion is felt until after the event has passed. It accounts for the expression "I did not have time to be afraid." Yet these same persons have experienced extreme emotion after the event; most probably due to the fact that the disturbed structures have had sufficient time to produce their effect. This involves a latent period, of which more will be said later.

61. Feelings.—Before continuing further some idea must be had of feelings. They are so closely allied to emotions that there is difficulty in separating them. It must be understood, however, that many bodily changes are in progress all the time and unless abnormally introspective they are not felt. Such are the movements of the intestines in digestion, the pressure of clothing against the skin, the respiratory movements, heart action, etc. A neurotic individual feels these and interprets them as pain, palpitation, and other pathologic symptoms, but the normal individual is unconscious of them unless he concentrates his attention on them. Thus hunger, pain, fatigue, aches, nausea, indigestion, headache, palpitation, chills, fever, and other local or widespread complexes which are termed feelings are experienced. According to the James-Lange theory, these do not constitute emotion unless they occur in such complex, diffuse patterns and in such force that they flood the central nervous system with nerve impulses and sensations. The term emotion is applied to a

fusion of these disturbed activities with their feelings and not to bodily activities themselves.

Unless these bodily activities are increased so that they break through the natural barrier in the central nervous system they do not constitute or establish an emotion. A situation must call forth a considerable organic response before the experience is recognized as emotion. Such relatively simple or localized bodily reactions as hunger, thirst, nausea, indigestion, or palpitation are not termed emotions, nor are such bodily sensations as muscular fatigue, fever, and chills. However, combinations of these with other diffuse reactions in smooth muscles and organs are recognized as fear, anger, or love.

A well-known authority has propounded his "Emergency Theory of Emotions," and has been able to prove some of his points. The basis for this theory lies in the preparation of the body for fight or flight. He has been able to demonstrate that in predicaments which result in emotional response the adrenal gland pours forth a large amount of adrenalin. This gives the organism a sudden reserve of power and it is able to perform tasks which at other times would be impossible. The large amount of adrenalin causes constriction of the blood vessels of the organs, skin, and muscles, increases the heart action, slows or stops digestion, and sharpens the perception. A person awakened from a sound sleep by a fire in his home is at once wide awake and ready for action. The action of this substance is similar to the impulses from the autonomic system and augments it in a time of stress.

62. Somatic influence.—There are many muscles involved in an emotion and through the proprioceptors of muscles, tendons, and joints, impulses arise. F. H. Allport in his "Social Psychology" offers the theory that these impulses from the muscles, joints, and tendons added to the impulses from the autonomic system form the sensory complexes by which emotions of the same affective class are differentiated from each other. The somatic portion, that is, muscles, joints, and tendons, responds with postures and attitudes, the nature of which form the impulses mentioned above. Attack, flight, facial expressions, and other bodily movements cause the patterns which differentiate the emotions. Allport offers in corroboration of his theory the fact that after a situation calling forth anger or embarrassment has been removed, there still remains an unpleasant affective state, due to the more sluggish return to normal of the visceral components. This accounts for the period required to recover composure after an emotional episode.

The sudden change from fear and flight to rage and attack is seen in the animal which is brought to bay. This change is too rapid to have been due to a complete change in the visceral pattern. It is attributed by some writers to the much more rapid change in the pattern of the voluntary or striped muscles superimposed upon the constant visceral undercurrent of unpleasant affectivity. Bodily pain and grief also pass quickly into anger through a change in the nature of the somatic response.

Genetic development offers much evidence to support the above views. Judging from behavior, the emotional states of the newborn baby have no further character than unpleasant affectivity. The first stimuli to act upon the child are usually those for which the somatic responses are diffuse and undifferentiated. Such stimuli are seen in hunger pains, colic, or unfavorable temperatures which call forth the same somatic responses of crying, kicking, etc. At the beginning of life feeling there is little to differentiate the emotional states beyond pleasantness and unpleasantness. These are states and not emotions as yet. Allport calls this simple unpleasant experience of the newborn the "protopathic" state. The affective component is both the most primitive ingredient of human emotion and the fundamental basis of the classification of the emotions. As soon as the appropriate stimuli are brought to bear the child brings into play the prepotent somatic responses of struggling, rejecting, and withdrawing. These differentiating factors are added to the sympathetic pattern and we find anger and fear emerging as distinct emotions.

63. Stimulus intensity.—Unpleasant emotions are favored by numerous conditions. The intensity of the stimulus is a very important factor and no doubt almost any sensation becomes unpleasant if it becomes so intense that the impulse is forced over into the sympathetic field. This is seen in the sensation of pain which if light is not necessarily unpleasant, but if it becomes more intense it is extremely unpleasant. Severe pain is unpleasant. The repetition or insistence of a stimulus may act to arouse unpleasant emotion. All have seen this in action in the case of good-natured bantering kept up until the object of it has lost his patience and sometimes his temper. The repeated touching upon a "sore point" will cause this reaction. The suddenness of the stimulus or the lack of proper somatic adjustment of the cerebro-spinal system often causes the impulse to be discharged over into the sympathetic field. Strange, unfamiliar, or unusually large objects arouse fear. The child confronted with an elephant for the first time is often frightened. The sympathetic is often invaded when the usual somatic response to the powerful drives of sex and food

are blocked. This occurs usually through social restraints and we find this to be more true in the highly civilized peoples. When vital needs are thwarted as in industrial conflicts, overt struggle reactions, fear, and anger develop. Grief results when love reactions are blocked and where attack would be of no avail. The sympathetic threshold may be lowered and unpleasant emotionality be increased by the state of visceral tonus or preparation. Emotional attitudes such as irritability indicate a permanent lowering of the resistance of the sympathetic threshold. Moods and transitory effects increase the susceptibility to fear or anger. Food can cause a change in feeling and all feel better after a good meal. At that time stimuli can be withstood which at another time might create an extremely unpleasant emotion.

From the above discussion of the nature and physiology of the emotions the following definition may be drawn: An emotion is a complex group of vague feelings resulting from pronounced and widespread changes within the body.

64. Classification.—*a. Group.*—Emotions have been classified in many ways. There have been many suggestions but no single one seems to have been satisfactory to all. Emotions naturally fall into two large, distinct groups and all emotions can be placed in one or the other of these groups, being further differentiated by minor or major effects of the affects. These two groups are the pleasant and the unpleasant. The emotions falling under the heading of pleasant are of the approaching type and those under the unpleasant are of an avoiding nature. These two groups are more or less physiologically separate in that the unpleasant emotions are brought on by an action of the sympathetic divisions of the nervous system while the pleasant ones are realized by the activities of the cranio-sacral division of the autonomic system. However, it is not to be supposed that either division holds complete sway at any one time, but rather that one is dominant during a certain type of emotional response to a predicament and the response is toned by the effect of the other division at the same time. This may be the very solution to the problem of the intense and the mild emotions and all the shades in between. The intense emotions are thought to be the ones having the most instinctive coloring and observations tend to bear this out. Surely fear and rage attend flight or protest instinctively aroused. The bodily reactions attending these emotions, or rather preceding them (if holding to the theory), are instinctive beyond doubt.

The cerebro-spinal system is believed by many to supplement the cranio-sacral division in producing such pleasant emotions as elation,

mirth, the emotions accompanying exercise, and the excitement attending games and sports.

Many writers hold, and evidence supports their views, that there is a marked difference in the resistance of the synapses of the sympathetic and the cranio-sacral divisions to the transmission of stimuli. The sympathetic synapses are much more resistant and therefore the responses producing the visceral reactions known in unpleasant emotions are much slower in appearing than are those of pleasure. All know how much more quickly they thrill with pleasure to pleasant situations than they flush with resentment. There is a latent period in each situation but in the case of the unpleasant emotion it is appreciably longer. In the child the response to a tickle is immediate while the cry of anger is definitely delayed in its development. This serves to protect from minor annoyances.

b. Major—(1) *Defined*.—Up to this point the discussion has centered about the simple type of emotions. The simple or major emotions are fear, anger, and love. There are many other emotions but they can all be shown to be modifications of one or a complex of two or more of them.

There are many states in which both the pleasant and the unpleasant elements may be identified. Allport's discussion is perhaps the most clear.

(2) *Mixed*.—A simple object or situation acting upon a limited area of smooth muscle can produce but one type of affective response, pleasant or unpleasant. If the control is assumed by the cranio-sacral division the antagonistic sympathetic effects are inhibited, and vice versa. However, the situations are sometimes complex and there is apt to be a response with varying reactions to different aspects of it. In this case the cranio-sacral division will be controlling certain regions of the viscera while the sympathetic impulses are invading others. The result of this mixture of control is the mixed emotion, containing representatives of both the pleasant and unpleasant divisions of the classifications. Grief is an example of this type of emotion and contains the pleasant feeling tone of the love reaction and the unpleasant thwarted feeling of sadness because it is impossible for the habitual love response to be fully carried out. This explanation of the mixed emotion is entirely tentative but may be a possible manner in which to conceive the physiological factors.

There are many familiar complex emotional states in daily life. The major emotions of fear, anger, and love are toned by varying degrees of affective qualities, and also with somatic attitudes for all possible reactions toward self and others. Fear seems to be the

basis of the emotions of awe, reverence, bashfulness, surprise, wonder, suspicion, loathing, and anxiety. On anger we find based remorse, resentment, jealousy, envy, reproach, scorn, and hatred. Love plays a part in gratitude, grief, pity, sorrow, fascination, and perhaps humility. A number of body attitudes, other than attacking, fleeing, and caressing, combine with pleasantness and unpleasantness to produce special emotional reactions. A variety of approach and avoidance as well as joy, elation, pride, conceit, shame, domination, submission, and feelings of inferiority represent these states.

65. Association conditioning.—Emotions are conditioned by association. Fetishes and tokens operate upon the human feelings through conditioning. Everyone has at some time or other saved mementos of some occasion or other. The fond parent lovingly saves a lock of the boy when he gets his first boyish haircut. Savages bow before effigies with the same reverence and awe they feel toward the spirit it is supposed to embody. One carries about a watch which was his father's because of the sentiment attached to it and the memories it arouses. Sentiments are but conditioned emotions. The politician stirs his audience with references to "individual liberty," "states' rights," "the constitution," etc. The great veterans' organizations play upon the emotions of the people through the media of poppies, gaudy uniforms, and blaring bugle corps. There is no denying that controlled arousal of sentiment, whether for good or ill, is of great significance.

Emotions have created a social problem. At this time the entire world is involved in emotional upheaval. In Europe leaders are stirring masses to the destruction of life and property. Uncontrolled, emotions are likened to sensitive explosives.

Political campaigns are beautiful examples of appeals to the emotions. Most, if not all political speeches are prepared not to cause logical thinking, but to arouse the voter emotionally. Most issues are settled on an emotional basis. Very few ever arrive at a conclusion by cold facts and reasoning.

The emotions, especially those more intense ones of fear and anger, were better suited to the need of uncivilized man. But as civilization has brought people together and means of travel are improved there is less need for emotions of this type and more need for those related to love. If humanity is to remain on the high level which it has attained the emotions must be conditioned socially to that end. If somatic responses are totally inhibited, the visceral energizing effects can be discharged only inwardly, producing lasting and intensified states of unpleasant internal feeling. Social and familial ties may

be so strong as to result in blocking overt anger release and the outcome is an introverted, moody, and ineffective personality. If social influence represses the love emotions, there results auto-eroticism, daydreaming, and neuroses.

66. Factor in aviation.—Perhaps there is no vocation in which the emotional factor plays a more important part than aviation. A man is out of his element, surrounded by countless dangerous situations, his life and that of the passengers depending upon an emotional stability which will enable him to react at times with lightning-like rapidity. It is well known that resentment, irritation, anxiety, surprise, and many other emotional states retard the thought processes and cause one to make mistakes and errors of judgment which would not have been made under other circumstances. Where would the pilot be who became paralyzed from fright in a spin? No doubt this has been the factor responsible for many a fatal crash in the past. The wartime flier tells that the greatest dread of the war was the fear of the spin and falling in flames. Even now with the training given in correction of spins crashes occur and though the fault is often found to be with the plane, the fact is the pilot had much to do with the outcome. One wonders if the plane is not just an inanimate object used to bear the brunt of the rationalizations of the pilots, as well as those on the investigating boards.

Many flying trainees wash out because of tenseness, especially when near the ground or other planes. This is a direct result of the basic emotion of fear. At times men have frozen on the stick when in a precarious situation. The instructors at flying fields all have a fear of the student freezing onto the controls and very often the remark is made that the man is rigid on the stick. This is noted also in the student who is nervous under criticism and tries to correct his mistakes so hard that he loses the relaxation which gives him smooth manipulation and his control becomes jerky and incoordinated.

The emotionally unstable pilot is apt to carry financial or family troubles into the air with him with the result that he is preoccupied and inattentive. This is no doubt the cause of many air collisions seen in older and more experienced pilots. In these men it cannot be inexperience but some other factor which has recently become a source of danger to him and others in the air. It is by no means meant to imply that all of the pilots who crash are emotionally unstable, but it is shown by fact that in the past most of the accidents have been due to pilot error and in some cases it can be shown that there has

been some emotional build-up to the accident. Flyers are extremely sensitive to anything which tends to reflect upon piloting skill or ability. It takes little to injure the ego of the flier and when this happens there is naturally resentment.

This tends to create an intolerable situation. Something must be done to reestablish that perfect harmonious state of adjustment and feeling of well-being, not only an adjustment with the external environment but an internal adjustment, or an adjustment with self as well. This creates a situation which is fraught with many possibilities. The actions of the pilot are not controlled and guided by rational and logical thinking but he is swayed by emotions, which makes for recklessness, daring, and faulty judgment.

In observation of the applicant and of the flier himself full value must be given to those little peculiarities of the individual. This man fumbles with the buttons on his clothes, another perspires profusely, still another shows resentment that he should be asked to perform the seemingly foolish things required in the examination. These things fit in that they are the small parts of the picture which viewed from afar give a composite, but seen each by itself may be overlooked or considered of little importance. They are the small strokes which change a smile to a frown. They must be brought out by careful and skillful questioning. In the examination a man is on the defensive. Facts are going to be concealed intentionally or otherwise. What the man's reaction is to teasing; how much he has fought in his life; how much the examination has upset him, and many other things can be elicited during the procedure.

The personal element of the examination can never be eliminated but experience soon enables the flight surgeon to estimate emotional stability to a high degree of accuracy. He must keep in close contact with his pilots and especially with their social lives, for it is here that he finds the pilot off his guard and reacting to the social contacts. Here the traits mentioned above are seen at their best and it is here that those changes in personality are noted which must be used as criteria for grounding the flier.

Problems of emotion are with all in every walk of life. The proper control of them individually and en masse will lead to a more enjoyable existence, but uncontrolled they can lead but to disaster.

SECTION X

INSTINCT

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67. Designation of action.—Instinctive action is thought by many investigators to be the key to the understanding of human behavior. These investigators believe that human behavior is built upon a basis of innate tendencies which are in all essentials very similar to the instinctive tendencies in animals. While there is some disagreement with this view, it has been asserted that instincts and intelligence are two diverse developments of mind that have little in common. In the course of evolution, mind arrived at a parting of the ways. The path of evolution was split into two divergent paths, instincts and intelligence. The insects followed the former, the vertebrates and mammals followed the other path and developed intelligence until it culminated in the intellect of man.

The mechanistic school sees in instincts nothing more than complex reflex action as exhibited in chain reflexes and tropisms.

While the designation of what is instinctive activity has not been accepted by all, most agree that those actions of animals which seem to be purposive and which are performed by animals independently of previous experience may be called instinctive. Instincts may be considered as native or inborn capacity for purposive activity, while intelligence is the capacity to improve upon native tendency in the light of past experience.

68. Nature.—The typical instinct is a complex disposition in which at least two parts may be distinguished, perception of the spe-

cific object, and the part which determines the outflow of energy into all the bodily organs that take part in the instinctive activity. When an instinct is excited in an animal its behavior may involve a great output of energy and persistence; the animal may persevere even unto death. How is this output of energy to be perceived, when does it come and how is it liberated? First, each instinct might be regarded as containing a store of potential energy which is liberated and directed into appropriate channels when the instinct is excited, and which leaks or overflows in that restlessness seen to be characteristic of appetite. Secondly, the several instincts of the animal might be regarded as somehow drawing upon a common store of reserve energy. The second seems more logical, but if this is correct it must be recognized that all instincts do not draw upon this common store with equal facility and freedom. It might be better to say that the excitement of "an instinct" evokes "an impulse" to action; that this impulse is variable in strength with any one instinct according to the condition of its excitement; and that the impulses of the several instincts of any animal are not capable of the same maximum strength.

When an instinctive impulse is liberated, the organism becomes absorbed in the endeavor toward the goal of the instinct; its reaction to the exciting object is a total reaction; its energies are concentrated on the task at hand, and the functioning of the various organs is subordinated to and harmonized with the dominate system of activity.

An instinct may be defined as an innate disposition which causes the animal to perceive any object of a certain class, and to experience in its presence a certain emotional excitement and an impulse to action which finds expression in a specific mode of behavior in relation to its object.

Each instinct develops in the organism gradually, and may express itself in partial and incomplete fashion before it is perfected. The changes noted in the expression of the instincts are in no way influenced by the environment, but by maturation of the organism.

It is probably true to say in general terms that exercise of instincts in normal degree is essential to the fullest vigor and health of any animal. It must be recognized that the instincts of an animal are its very essence and central core, all its bodily organs and functions being merely the servants of the instincts.

Instincts are the most characteristic thing about any species. They may be regarded as so many differentiated channels through which the vital energy (libido) pours itself into or through the organism. Two or more instincts may be simultaneously stimulated. If their tendencies are compatible, behavior is then a blend of the two. If

their tendencies are incompatible, there is a struggle until one gains the upper hand.

Instincts are specific, both on the receptive and on the executive side, but they are of very different degrees. The more highly specialized the instinct on both sides, the less scope is there for the play of intelligence, and the less specialized the instinct, the greater the scope for and the demand for intelligence to supplement instinct. An example of highly specialized instinct is found in the Yucca moth. As the scale of intelligence is ascended there are less and less specialized instincts, until the highest is reached in man. Here intelligence plays a large part in modifying instinctive behavior.

69. Characteristics in man.—Study of instinctive activity of man has always been handicapped by the assumption that man has all the instincts that animals possess. Recent observations tend to disprove this. The infant has relatively few unlearned behavior patterns at birth.

Instincts in man are not clearly defined. The tendencies toward a specific type of behavior which can be definitely determined are ill-defined. Because of his plasticity, his great power of learning, any complex instinctive pattern is soon overlaid and modified. As an infant he is helpless. For years he is incapable of making his own way in the world. During this period his every want and necessity is supplied. By the time he is in a position to take care of himself, the molding influence of the environment has had its effect. He has adopted habits and customs common to the group. During this training, instinctive behavior has been so modified that about all left in the original form is the urge or libido. The instinctive urge to reproduce is still present, but the mating will be determined by the dictates of society. As a child, the instinct to be active will be present, but the type of games played will be determined by the customs of the country.

Instincts are an expression of a biological urge. All the so-called instinctive activity of man rests upon his basic urge to action. As long as an organism has life, it tends to act in some manner or other. The life story of man is largely the account of his change from an inefficient child to an adult who responds efficiently and intelligently to his environment. It may be assumed that the biologic urge is behind all conduct, but it is to be taken for granted rather than used to explain specific behavior.

Instincts are modified by social demands. Whether the biological urge to activity is still in its undifferentiated form or whether it has become specific, it is continually running counter to social and

environmental restrictions. Conduct is a compromise between inner urges and social restraints. People want to eat, but they can't steal food, eat it with the hands, or spill it over their clothes, and at the same time gain the approval of comrades.

When some urge cannot be expressed in a direct manner, it may appear in an indirect form. This is called sublimation. A woman being denied a child may become a teacher of children, or may adopt a child. The interest shown by individuals in a certain line of endeavor may depend upon such a solution of their problem. They make excellent workers as long as the work continues to be a satisfactory outlet for an otherwise ungratified urge, but let the urge be gratified in its native way and interest in the work is lost.

70. Classification.—All conduct may be said to spring from one general tendency to be continuously active and it is possible to classify the forms in which this tendency expresses itself. Classification of these forms, however, is merely descriptive of behavior observed from an extreme point of view and does not presuppose any specific types of urge to correspond. It includes acts which tend to facilitate survival, those which tend to preserve the race, those which intensify egoistic experience, and those which facilitate social survival.

a. Facilitate survival.—The seeking and accepting reactions, resistance, including rejection and withdrawal, as well as struggling and fighting, and perhaps the play reactions, are instinctive tendencies of this group. The infant shows "startling" behavior when support is removed, when loud sounds are suddenly introduced, or when it is immersed in water. Within a few days definite withdrawing responses are elicited by unpleasant stimuli, and by intense tactile stimuli on the feet or hands. Any interference with the random movements of hands or feet is met with definite struggling behavior on the part of the infant. These struggling movements are probably the first manifestations of what is later the fighting reactions of the individual.

As these reactions appear in infants there can be no knowledge of the end involved, but they represent very necessary forms of behavior for the preservation of the individual from a biological point of view.

b. Facilitate race survival.—In this group are those tendencies which depend upon the maturation of the individual for their physical basis. To a certain extent they are subject to conditioning influences of custom, convention, and the morals of the group. The urge to mate is common to all species. In human beings this tendency gradually becomes dominant as adolescence passes into early maturity

with accompanying maturation of those organs upon which the act of mating depends for its essential fulfillment. Courting and love making take on the coloring of the social group. Parental love and care for the young, and the love responses of the offspring develop biologically with the tendency, as evolution of higher forms advances, toward prolonged infancy and helplessness of the young. Racial continuity as well as immediate social organization depend upon them.

c. Intensity egoistic experience.—The child gradually senses his individuality, and much of his behavior is an expression of his instinctive tendencies to intensify this experience of selfhood. Acquiring things or collecting objects of no value except to the child who acquires or collects them illustrates the phenomenon. Under normal conditions the child seeks egoistic expression. The dominant person is egoistic and has positive effective experience from his supremacy. The man collects and builds and creates primarily because of his instinctive desire to further his egoistic expression. A very important fact of human behavior is found here. Even the most apparent altruism has its real foundation in egoistic desire and the individual tendency to achieve self-expression.

d. Facilitate social survival.—Man cannot and does not live alone. Throughout the long evolutionary development of living things the tendency toward maintenance of group relationship becomes more and more evident as the higher level of development is attained. The protective reaction of parents, the filial relationship of children to parents, the broader tendencies toward social sympathy and conformity, are present in all men. They form the basis for all social continuity and social relationships, as well as the battleground for all personal conflicts. To satisfy the urge toward self-expression and to maintain at the same time the adequate satisfaction of social needs is not easy. The struggle for survival in an early day may have been primarily biological even on the human level. It is rapidly becoming a social one.

71. Integration of tendencies.—If personal history is analyzed or the lives of others are observed carefully, it is soon realized that in normal conditions these instinctive tendencies form the basis for a satisfactory development of individual personality and social continuity. The most highly developed human being is one whose behavior gives evidence of an adequate balancing of these tendencies. Normality consists in the maintenance of satisfactory adjustment between the organism and the environment. The biologic, egoistic, and social drives of the individual are expressed by behavior in

terms of environmental demands and immediate needs. Environmental demands which inhibit adequate expressing of instinctive tendencies cause repression on the part of the individual. From the point of view of developing a balanced personality this may be dangerous or disastrous, but over-expression of instinctive tendencies may become socially undesirable, and create as a result a social problem.

The urge to eat, to make love, to reproduce, to accumulate material goods, to be with one's own kind, are not found in isolation but in combination. The balancing of these tendencies into an integrated program of behavior is facilitated by the intelligence with which a man discovers himself and acquires a mastery over his environment.

72. Random movements.—There is another type of behavior which may well be classified as innate. The small child kicks, squirms, waves his hands, and makes other types of responses. Such responses seem to be due to stimulation from clothing, digestion, and possibly, as some have suggested, from the semicircular canals.

The chief characteristic of this type of behavior is the unpredictability of the form of response. In reflexes, the response to a specific stimulus may be predicted with exactitude. In instincts the form as well as the complexity is more variable, yet it is predictable within limits. On the other hand, watching a baby in a crib, it cannot be predicted what he will do next. He is continually active, but first he is doing one thing and then another. Such behavior is also present in adults, but here it is more or less complicated with many forms of learned responses. Explanation of infant random movement behavior seems to be that the balance for the different pathways in the nervous system is almost equal but variable. First one pathway is more variable and then another. As a result of such shifts, the form of such activity is also characteristically variable. If all the factors involved were known there would no doubt be an explanation for the shifts. They are random only because the causes of their variability are not known. Instead of being insignificant and unimportant, such random movements become the basis of many skilled acts.

73. Significance of unlearned behavior.—The forms of behavior which have become elaborated into modern life are founded upon a basis of innate behavior. All learning is superimposed upon native reactions. If native forms of behavior do not meet needs of the individual, such forms are modified and other more efficient forms are discovered. The complexity of these modifications run the gamut from the simplest responses in animals to the most complex economical and social responses in man. Yet the basis is innate; furthermore,

the drives for more adequate adjustments are fundamentally innate.

It may be far from the instinctive need for food to the elaborate economic institutions and methods of modern society. Nevertheless, for an adequate understanding of these forms of adjustments one must look to the innate drives of man. Food-getting tendencies and other human drives have become most complex in form and function. Modern home life is an elaboration of several innate tendencies, but undoubtedly sex is the strongest of these.

Under the stress of emotional experience and in situations where the environmental stimuli become excessive, the individual tends to react along his innate and most fixed pathways, or in other words he reverts to more primitive modes of action. When learned modes of behavior are inadequate and experiment fails to produce a satisfactory new co-ordination, older pathways carry the burden of adjustment. A knowledge of the nature and the strength of these instinctive tendencies enables one to understand better human behavior.

74. Social.—Many instincts are social in the sense that they arise in social situations, but there are certain tendencies which may in a narrower sense be described as social instincts. The first of these is the “gregarious” tendency. It is this instinct which is responsible for crowds, cities, etc. An individual may be gregarious without being sociable in the commonly accepted meaning of the term. “Imitation” should also be included. The tendency may be unconscious or fully conscious, and it is stronger if the person imitated has prestige or if the action imitated is performed by a large number of persons. The “responsiveness” of an individual to social approval or disapproval is also a very general tendency.

75. Conditioning.—In the beginning, either because of original nature or early acquisition, instincts are elicited by fairly definite stimuli or situations. As a result of further experience, however, an instinct comes to be aroused by other objects or situations which were associated with the original stimulus. This sensory modification occurs in relation to all instincts. This process of associating an instinctive response with a different situation is called “conditioning of an instinct.”

76. Modification of responses.—Instinctive responses undergo continuous change during the lifetime of the individual. The conscious impulses or drives remain very much the same. Modification of the pattern reaction is a matter of elimination of certain responses and formation of others. This change takes place as a rule in response to social demands. A more socially acceptable response is usually substituted for a more primitive one. This process is

essentially what is described by the Freudians as "sublimation." The fundamental importance of the drive is that in all these modifications of the instinctive stimuli and responses, the conscious impulses or drives remain relatively unchanged. It is a question whether all the instinctive drives are the same in nature or whether they can be distinguished as drives.

The various impulses may be regarded as parts or aspects of a general drive or "energy of life." In addition to instinctive drives this energy is expressed also in other drives of an individual nature. Well-established individual habits have their own drives.

77. Conflict.—The universal drives frequently come into conflict with each other, for example, tendency to escape and to fight, the ego with sex instincts, etc. They may also conflict with habit impulse. Such conflicts between these impulses result in a feeling of anxiety. If this be long continued it may have serious results. If the conflict is particularly intense one of the antagonistic impulses may be pushed out of consciousness altogether. This is what the Freudians call "repression." The repressed impulse may however remain active outside of consciousness and may express itself in various indirect ways.

78. Abnormalities.—*a. Nature.*—All the instinctive responses and impulses vary in degree from individual to individual. This distribution is in conformity with the normal curve of distribution. The largest proportion of the population would thus be grouped about a median amount of impulse or response. The more extreme deviations from this median or central tendency would be the abnormalities. The common abnormalities of the instincts are thus quantitative in nature. They are subnormalities or supernormalities. A third class of abnormalities is possible here as in the other mental processes. These may be regarded as qualitative deviations. That is, the instinct may be aroused by an unusual stimulus or situation. The conditioned instinct is thus abnormal because it is unusual. Another kind of qualitative abnormality is a very unusual or peculiar response to a normal situation.

Abnormalities of instinct may be regarded objectively as variations in the pattern reaction, and subjectively as variations in the conscious drive. The latter are the "abnormal impulses" so much discussed in popular literature. There are of course abnormal habit impulses as well as abnormal instinctive impulses. In other words, the individual drives may be abnormal as well as the more fundamental and universal drives. All these abnormalities, whether quantitative or qualitative may be due to pathological causes, but they

are more frequently merely constitutional variations of an inherited or acquired nature.

b. Nutritive.—It may be important to distinguish between hunger and appetite. Hunger is a sensation caused by the tonic contractions of the stomach. Appetite is the craving for food which is fundamentally instinctive in nature. This instinct may be aroused by hunger or by other sensations such as taste, smell, or sight of food. Appetite, the instinctive impulse, may be abnormally diminished in intensity. This may be caused by an absence of hunger sensations or to other factors, and it is one of the frequent causes of mental patients refusing food. Appetite may be abnormally increased or decreased, or there may be a qualitative anomaly, an abnormal craving for unusual kinds of foods.

c. Sex.—It is important to distinguish between fundamental abnormalities and unusual sex practices. This is a distinction between abnormalities in sex drive or craving, and unusual sex practices or habits which may be resorted to not by preference. A fundamental abnormality in the sexual impulse may occur without any overt sexual indulgence. There are numerous peculiar and unusual sex practices or forms of sexual indulgences, but only a few of the fundamental abnormalities will be considered.

They readily fall into two groups, anomalies of degree and qualitative anomalies. Those of degree are of two varieties, *anesthesia sexualis* or sexual frigidity, and *hyperesthesia sexualis*.

The qualitative anomalies may also be divided into two main groups. First, anomalies in which the sexual instinct is aroused by an unusual stimulus or object; and second, anomalies in which the sexual response or behavior takes an unusual form. These two kinds of qualitative abnormalities generally occur together since one usually involves the other. Autosexuality or autoeroticism would be of the first type. This abnormality results in masturbation. But this practice may occur without any fundamental autosexuality, which represents an early stage in development, and masturbation is a normal phenomenon in young children. Any harm which may result from this is due to the mental conflict and worry which it may precipitate.

The second abnormality in respect to the sexual object is "homosexuality." There are various degrees and forms of this abnormality. In some cases the individual has the bodily form and mental make-up of a person of the opposite sex. In other cases this does not apply, and the individual may be quite normal in other respects. A homosexual person is frequently bisexual. There may be a sexual interest in the opposite or the same sex. Freud believes that bisexuality repre-

sents a stage in sexual development following autosexuality, and that homosexuality in an adult is due to a fixation of development at this early stage. There may also occur, in addition to this fixation, a repression of the heterosexual components of bisexuality. This theory probably accounts for homosexuality in otherwise normal persons. In those cases with physical characteristics of the opposite sex, the perversion may be due to glandular disorders or defects. The "crushes" and hero worship may be explained as occurring before the individual has outgrown the bisexual stage of his development.

Of abnormalities which pertain to the sexual response or behavior, one class appears to be due to an exaggeration of the preparatory sexual impulses and behavior such as touching and looking. Exhibitionism and inspectionism are of this type. These abnormalities are exaggerations of certain common tendencies. Sadism and masochism are other forms pertaining chiefly to sex behavior. Both are usually found present in the same individual. According to the Freudians, these abnormalities are merely exaggerations of universal human tendencies of components of sexual instinct. Both are said to occur in symbolic form. In these forms the subject's impulses are satisfied by the humiliation of the object of sexual desire, or by submissiveness and self-sacrifice. Such abnormalities are thus closely related to the ego instinct, and may properly come under these instincts.

In general all abnormalities of the sex instincts are extreme variations of relatively universal impulses or pattern reactions and they are due either to fixation and failure in the process of development, or to conditioning of certain trends as a result of early experience.

d. Ego.—These are both quantitative and qualitative. The chief anomalies of degree; the feeling of inferiority, extreme submissiveness or self-depreciation; the feeling of superiority, extreme self-assertion and egotism; and closely allied to the latter, an exaggerated tendency to self display and showing off. These abnormalities may be due to an innate excess or deficiency of the instinct concerned, or they may be due to early environmental influences.

The feeling of inferiority may persist throughout life or it may be repressed and become an unconscious "inferiority complex." Physical defects, associations with superiors, harsh, stern parents, etc., may aid in the development of an inferiority complex.

Qualitative anomalies of the ego instinct are the various unusual or indirect methods of expressing instincts which arise when their direct expression is not satisfactory. Examples: "Winning by yielding" (coquette), "derogatory impulse," "excel by being the worst." The ego drive may thus be at the basis of much delinquency and crime. Doctors are well-acquainted with those cases where sickness is motivated by a desire to gain sympathy and attention. In this connection it is important to distinguish between the case of a patient who is conscious of the desire for attention and knows the illness is simulated for this purpose, and that of a patient who is quite unconscious of any such motive to his illness. The former is malingering, the latter hysteria or a functional neurosis. If the object is to escape an unpleasant duty, it is called "flight from reality."

e. Defensive.—Defensive are impulses to escape, to repel, and to fight. Such impulses may be markedly increased in intensity so that a person is unable to resist them. He may run away in the face of tremendous odds, or he may rush rashly into danger. On the other hand these impulses may be greatly decreased in intensity so that the subject does not try to escape in an obviously dangerous situation, or shows no tendency to fight when there are manifest causes for such behavior. The tendencies to escape, to repel objects, or to fight, may also be aroused in very unusual situations which present no danger whatever. The abnormalities of these defensive instincts are usually accompanied by marked emotional disturbances.

f. Social.—Social may show marked deviations up or down, a lack of gregariousness is shown by many individuals. Sensitivity to social approval or disapproval varies considerably among individuals. In dealing with individuals it must be recognized that there are differences among them due to individuality and to varying environmental conditioning, but the same basic tendencies are operative in all men, although different tendencies may be dominant in each case.

In the development of quantitative measures for the selection of men for specific jobs, an application of the principle governing innate human behavior is essential. Men who have failed to develop adequate self-expression on account of unfavorable environment or unfortunate repression do not succeed in many lines of work. It is evident that in any field where attempts are made either to select and control individuals for specific tasks or to influence in a general way the behavior of people, knowledge of the fundamental behavior mechanisms is necessary if success is to be assured.

SECTION XI

CONSCIOUSNESS

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79. Nature.—In the study of human beings the problem of consciousness sooner or later obtrudes itself. There has been much controversy and speculation as to the exact nature of the conscious, sometimes referred to as the “I” or the “Ego.” But what is the I or the Ego with respect to the mental constitution of the individual? From a psychological point of view, the individual is an integration of mental systems or parts, and the pattern of the functioning of this integration is the personality. The personality may be identified with the I or Ego. It behaves or manifests itself as a unitary something, as a single entity; it does this to the extent that it exists; to the extent that there is a true integration of mental systems. If this integration is lacking personality is lacking. Without an integration of the mental aspects of the individual there is no personality; the individual is simply a collection of unrelated parts, dispositions, or systems; now one, now another usurps the mechanisms of the individual, giving rise to that kind of disjointed behavior which may be observed in the small child or in the lower animal. It is the personality that is conscious; and the process or act whereby it becomes conscious of something is termed a conscious process or reaction. The act or process of being conscious is as near to an ultimate fact as can be gotten, and such facts can be neither described nor explained.

80. Theories.—At what point on the evolutionary scale does consciousness appear? In consideration of lower forms as, for example, the amoeba, any discussion as to whether it possesses a consciousness is futile. There is every reason to believe all its reactions are due purely to physical and chemical causes. If such structures have a sense of being, it must be one that is shared by the substance and energy of the universe generally. As the evolutionary scale is ascended, the question arises as to just where to assume that this sense of being begins. In the jellyfishes it may be right to set aside the question of feeling but is it justified to do this in the case of insects with their complex sense organs and nervous systems. Is it correct to assume that the cuttlefish in spite of his elaborate eye does not “see,” or

has not "light sensations" of some kind? It seems unphilosophical to assume that the fish in spite of its enormous olfactory brain does not smell, or being possessed of eyes and ears, that it does not see, does not hear. The impacts received by the nose brain, the eye brain, and the ear brain are all transmitted into the common paths concerned in swimming, that is, in bringing about automatic approach or withdrawal from objects in the water. However, despite the elaborate mechanisms possessed by the fish for seeing, hearing, and smelling, the consciousness of the fish must be something vastly different from that experienced by the human being. This difference may be explained in terms of the function of the telencephalon.

In ascending the evolutionary scale to the amphibians and reptiles there is little change in conditions. Responses are still the invariable, nonadjustable responses of the segmental brain. In birds the condition is found to be a little different. Here in addition to the complex automatic instinctive responses there appears to be a capacity, though an exceedingly small one, for adjustable responses. In the bird the cortex of the telencephalon is still very rudimentary and if the bird does any thinking he must do it with his thalamus and striatum. The fact that certain birds can be trained is fair evidence that in them the paleo-encephalon has in a measure the function of adjustable responses. From this it may be assumed that the segmental brain is of such character as to permit adjustable responses to a limited degree in the lower forms.

In mammals however the function of the segmental brain, like that of the spinal cord, is limited to nonadjustable responses. Like the spinal cord the segmental brain has been reduced to a fixed mechanism. Whatever may be the states of consciousness in vertebrates other than mammals, it is quite certain that in the latter fixed responses play no part in consciousness.

The telencephalon has played the role of usurper, for the function of consciousness as we know it is limited to the telencephalon. In considering the function of the telencephalon various acts, the effector results, of the intercalary function of the telencephalon when first performed are attended by consciousness. They may lose this quality when the act is perfected. In other words, when perfected the act becomes automatic. The performance seems to acquire all the character of fixed responses. The first inference that is justified is that consciousness disappears in proportion as fixation is established. Fixation in response means the disappearance of consciousness. This inference leads to another interesting inference, that consciousness is present only in the adjustable responses, that is, only in those re-

sponses which are attended by a changing; an actively varying relation among the neurones.

A stimulus transmitted from the cord and segmental brain into the telencephalon brings about definite changes in the synaptic relations of the neurones to which the impact is first transmitted. This stimulus is transmitted to other neurones in greater and greater numbers until those in relation with motor neurones of the segmental brain or cord are reached, when an outward motor expression results. Whatever the course of the transmission, it is inevitable that the neurones concerned are involved in sequence. To quote Dercum, "It is, I believe, a legitimate inference that a neuron at rest can have no relation with consciousness; a neuron at rest, so to speak, is unconscious." While Dercum does not make the statement, it might be inferred from this that consciousness is only present in the neurones that are actively concerned in transmission. Consciousness is itself a phenomenon of cortical transmission.

Whatever consciousness may be, it is something that is constantly changing. A sensation may last as long as the impacts that give rise to it continue; a perception as long as the object perceived throws its impacts upon the receptors; a thought resolves itself into a train of sequences. While consciousness is constantly changing from the immediate present to the immediate past, it is of necessity also constantly passing into the immediate future.

The route which an impact takes in the cortex is dependent upon the synaptic resistance; the pathways which have been used most often offer least resistance. In the beginning the routes of transmission were probably the most direct ones to the gateway of exit. However, the organism in response to the increasing demands made upon it by the environment reacted by increasing its powers of adaptation; it underwent evolution. As the telencephalon grew, its neurones became more numerous and its powers of adjustment increased. Numerous association tracts gradually made their appearance. Despite this development, an impact would not spread through the entire cortex, the transmission pursuing a course more or less defined. There is a main or central stream of transmission but also neighboring neurones are to a less degree involved. Consciousness, however, follows the main stream, but also includes a limited and fading field to either side or to all sides, that is, field of vision.

This train of activity is continuous, unbroken, during the waking period. Furthermore, the inpour of stimuli is incessant, and a given train may be reinforced, deflected, or modified in various ways. Cessation of the train of activity means cessation of the synaptic trans-

mission, a discontinuance of the synaptic connection. Such a break means unconsciousness and, physiologically, sleep. When functionally active, the neurones must be in contact with each other or nearly so. Evidently this condition is a prerequisite of consciousness.

Another view of consciousness, referred to as parallelism, assumes that mental and physical processes form two separate and distinct streams of events, neither of which influences the other. In the body all its movements, the whole physiological organic process of growth, the organ movements, and the disturbances in the nervous tissue are all purely physical. There is here the stream of consciousness and this stream of consciousness runs right along side the other. According to the parallelist theory, there are two streams of events which are absolutely separate.

The next theory is called the interactionist view. According to this view these two processes are not absolutely separate. The body might influence mind, and mind influence body in such a way that the two streams or processes interact, hence the word "interactionism" is used to describe this view.

The behaviorist refuses to admit the scientific problems of conscious behavior, and discards completely the whole subject of consciousness.

Referring to the parallelist theory, if psychological processes move on one level and the consciousness stream on another level, and if neither one has any influence on the other, a second problem occurs as to how the distinctly separate processes correspond so closely. It is a wonderful coincidence that for every physical state there is a certain mental state.

The school which claims that consciousness is produced by the physical stream of activity, in other words, the physical is the cause of consciousness, was advanced by Huxley. Others claim that consciousness would, by this view, be mechanically determined and would have no more to do with life than a pencil mark would have to do with determining the making of the mark. One body movement would cause another body movement, and there would be no possibility of variation. This is the view held by the materialists or mechanists.

If consciousness has nothing to do with the behavior of an organism, how did it come to be evolved in the struggle for existence? In evolutionary development those things tend to be preserved which work to advantage in the struggle for existence. Now it seems the higher organisms have the most consciousness. Consciousness must have had survival value. It would seem strange to assume that con-

sciousness should have nothing to do with things which it so closely attends. Consciousness and feelings of pleasure and pain seem on showing of biological facts to have survival value. Therefore they must lead to actions which are advantageous; and therefore they must have something to do with determining bodily movements.

The behaviorists in their efforts to eliminate consciousness fail to take into account some of the more complicated facts of behavior, referring to that behavior which seems to show foreknowledge of events. Foreknowledge of results means that consciousness enters into behavior and makes a difference in the bodily responses to stimuli.

Psychopathic behavior in many of its phases is characterized by the fact that an individual automatically, mechanically, performs habits in situations where such behavior is irrelevant because they are not adjustments to future ends. There seemed to be an absence of foreknowledge of results, and the process was without conscious guidance.

Dunlap has repeatedly called attention to the fact that in any total situation involving what is called conscious experience or conscious reactions there are three aspects which must be distinguished if one is to remain clear and consistent in his thinking: There is that of which something is conscious; there is the process or act of being conscious; and there is that something which is conscious. The first is the stimulus, the second is the response, and the third is the individual who makes the response. According to the stimulus-response school, the response is always conscious or near conscious. In the absence of observable reaction it is not always possible to say that the reactor perceives a stimulus. He may report perceiving it at a given time, and not perceiving it at another time. Secondly, he may respond to a stimulus and report that he was not conscious of it, again he may report that he was conscious of the response. Evidently there must be some difference of one kind or another between the total situations. This difference can be described and understood adequately only in terms of the concept of conscious reactions.

Behaviorists claim that consciousness is neither a definable nor usable concept; that as it is merely another word for the soul of more ancient times, consciousness (although it may not be definable) is an assumption of the existence of something between the response to a stimulus and a sense of awareness, of recognition of the cause of a given sensation of perhaps a purposeful character of this response, indicating foreknowledge.

It is not known how a message from a sense organ is translated into appropriate bodily movement. Probably the conditioned reflex explains it. But even this cannot wholly explain it, because the synapses between the neurones are not equally receptive at all times to nerve currents. Some psychologists assume there is some selective process going on in the organism.

Whether consciousness is necessary to explain human behavior or whether, if taken into account, an adequate explanation is had; whether behavior can be explained mechanically; whether an individual really has alternative modes of response to certain situations; or whether, given the same physical conditions, one must always behave in the same way are all problems which are not settled, but they are vital problems in trying to understand human behavior.

Medical officers trained in anatomy must not think that psychology and physiology are occupied with two separate and distinct kinds of existence, and whether they think of an organism functioning as the psychologists do or as the physiologists do, they are bound to see they are merely taking two views of the activity of the same being. Scientifically the organism is one. Mental life, regardless of how thought of, cannot be separated from physical processes.

Psychology without consciousness fails to explain some of the more complicated facts of behavior. The type of behavior referred to is that which seems to show foreknowledge of events. It seems that in this type of behavior foreknowledge of results is a selective fact or which influences response or reaction. The conscious or consciousness is a concept, and like any other concept its validity must be measured in terms of its value to those who make use of it.

The psychoanalytical conception advanced by Freud might be called the focal view, that is, he holds that consciousness is only a small part and a rather incidental part of the psyche. The greater part and most important part of the mental life of man goes on unconsciously. This deep location of the memory traces of life and inherited impulses in lower nerve centers he calls the unconscious. There is a small portion of responses to a stimulus which is lighted up and is conscious under certain circumstances. Consciousness is located, he thinks, in the cerebral cortex or the gray matter on the convoluted surface of the cerebral hemispheres. Freud claims that through a process of evolution this surface of the brain developed from a primal surface of the cell. It has always been greatly exposed to stimuli; it has been played upon so many times that all capacity to remember has been taken out of it; it does not retain, and therefore it acts in-

stantly and its instantaneous action is consciousness. This view it must be remembered is an hypothesis and explanatory concept only, and many do not consider it in accord with observable data. For instance, when conscious the gaze at things is not blank and they make their impressions; impressions are not merely received. Consciousness is an active not a passive thing. What is done is contribution of something out of the thought processes out of memory. There would be no knowledge of anything if there was no contribution to awareness of objects some elements of past experience.

Most workers who employ the concept of the conscious conceive of it as being entirely relative, not absolute. One may be acutely conscious of a thing or he may be just barely conscious of it. The subconscious is the term coined by one authority; while another in his work uses the term coconscious which refers to the same phenomenon. When meeting someone that reminds one of another, but unable to determine what it is, it is explained as being due to subconscious perception of certain stimuli or factors in the situation. In experimenting with patients it was found they did and did not perceive certain stimuli. This seemingly paradoxical phenomenon was explained by assuming two more or less unrelated mental or conscious systems in the individual at the same time. Those perceptions belonging to the normal personality were termed conscious, and those of which the individual declared himself to be unaware were termed subconscious. These patients were both conscious and unconscious of the same thing at the same time. Those perceptions which belonged apparently to the normal personality were termed conscious, and those of which he declared himself unaware were classed as subconscious.

Freud conceives of three divisions, the conscious, the foreconscious, and the unconscious. The conscious is primarily a perceptual mechanism; a cross section at any instant would reveal those perceptions, wishes, thoughts, etc., which comprised consciousness at that particular time. The foreconscious constitutes the great mass of data which is readily accessible to the individual but of which he is not conscious at the moment. There is continuous free and ready exchange of material between the conscious and the foreconscious. The unconscious is a wholly different matter. According to his theory there are two fundamental drives, urges, or motivating principles. The one manifests itself in the various forms of activity which tend to satisfy the body needs, and is referred to as self preservative. The other urge and the one of prime importance insofar as this conception goes is that of sex.

Early in life the sex urge begins to manifest itself in definite overt manners. During the first stage, the autosexual, the child derives sexual gratification from certain erogenous zones. This is succeeded by the bisexual during which time he is considered polymorphous perverse; the sexual drive or "libido" may become directed or attached to any object in the environment. Normally the libido becomes attached to a member of the immediate family, usually one of the parents. Early in life, six or seven years of age, his sexual trends begin to come into conflict with socialized customs, and the natural overt expression of his sexual urge is inhibited. As he grows older he develops moral notions and standards based upon the ego instincts. These come in conflict with the sexual urges, desires, or wishes, which are directed toward some member of the family, with the result that the sexual desires are repressed. Being repressed they are no longer consciously perceived in their true nature. And it is for the most part these repressed sexual desires or wishes that make up the unconscious.

The sex urge is conceived as being truly dynamic in nature; it is a drive, a push, a motivating principle which normally expresses itself or finds an outlet in overt behavior. Secondly, it must be kept in mind that to begin with it is nothing more than a blind urge tending to manifest itself in certain ways, through certain mechanisms. The unconscious cannot think, it can only wish. It is only when the true significance of his acts and desires become apparent to the child that the desires are repressed; and it is only and exactly because they are incompatible with his moral idea that they are repressed. When repression occurs, it involves something more than the urge or naked desire. It being consciously recognized, the urge has become linked with certain objects; it has been clothed, so to speak, in meaning or cognitive elements. In short a sentiment has become developed, and when repression takes place it is the whole sentiment and not merely its conative aspect that is repressed. An urge can become conscious only in the sense that the individual may become conscious of its manifestation in the form of thoughts, verbalized wishes, desires, overt activity, etc. In other words, an individual's urge or direction of an urge becomes clothed by the individual's conscious perceptual experiences and behavior. Therefore, if such experiences and behavior prove incompatible with the moral values and self-interests of the person, the whole complex of perceptual and ideational experiences with which the urge has be-

come incorporated, by means of which it has been manifesting itself, becomes repressed or unconscious.

Since the time of Wundt, the terms conscious and mental have been used in a practical synonymous sense. Of more recent years, however, with the growing interest and study of abnormal phenomena, the tendency has been to use the term mental in a general sense to characterize all psychological processes and events, and to limit the term conscious to those events and phenomena of which the individual is normally aware. Or, consciousness may be referred to as the immediate awareness of psychic experience. Psychic acts are immediate objects of consciousness because they are in themselves present in the faculties perceiving them. Awareness of them is a primitive act of unreflective cognition, which is the foundation of other cognitional acts by means of which the mind obtains a knowledge of the nature of our psychic acts, and of the objects they represent to us. Among the acts of the mind by which the cognition constituting initial consciousness of objects is developed into a full knowledge of them are noticing, comparison, distinction, analysis, abstraction, and apperception. Inner experience is noticed first when our attention is directed to it and its twofold aspect of being an act of the consciousness and a representation of an object is distinguished. In this incipient stage of knowledge subjective experience of the psychic act is distinguished from its objective content. Then the content of the act is compared with the content of other psychic acts and each is found to possess its own identity. Continuing the comparison, content of distinct psychic acts is analyzed by separating them into their components, and by observing which of these components is common to more than one content and which is proper to any of them. Finally, the act of apperception takes place when the content of a psychic act is interpreted, classed, named, and joined with other previously known contents by reason of its similarity or identity with them. This exposition of the mind's progressive cognitional activity, which can be verified by observing self, shows that the psychic acts termed consciousness are initial cognitional acts, but that they are distinct from knowledge as understood in the full sense.

The sensory content of consciousness possesses the important characteristic of being devoid of the corporeal properties it represents.

81. Content.—There is no generally accepted classification of the content of consciousness, but the scheme found useful for purposes of discussion is fundamental or derived, sensible or spiritual, experienced or recalled, and objective or subjective.

a. Fundamental or derived.—A fundamental content is one that is first in its own order. A derived content is one that originates by the combination or elaboration of fundamental contents.

b. Sensible or spiritual.—A sensible content is one that takes place in a sensory or central organ. A spiritual content is one that is in the mind or the will. The sensible content is concrete and the spiritual content is abstract. Blue is a sensible content, while blueness, virtue, etc., are spiritual contents.

c. Experienced or recalled.—An experienced content is one that is formed in consciousness by the use of the faculties. A recalled content is a past experienced content of consciousness that memory brings back into it again. When a problem in logic is solved the pangs of hunger are suffered, these acts are experienced content while they are taking place. When remembered in later years, they are recalled content. Every experienced content is capable of being recalled. Experienced and recalled content are often mingled.

d. Objective or subjective.—An objective content is one that represents a real or imaginary object without any further relation. A subjective content is one that expresses psychic attitude toward an object of knowledge. Sensations and concepts are objective content. Feelings, acts of the will, and judgments when the latter are psychologically considered are subjective contents. The acts of the intellect, considered in their logical and metaphysical aspects are not subjective contents.

82. Structure.—*a. Nature and properties.*—Consciousness understood as the aggregate of all the psychic experiences of the individual. The structure of consciousness is the connection of the psychic experiences of an individual into a unit and their relations to one another within that unit. The field of consciousness includes the number of objects which can be seen at one time.

Many psychic experiences are commonly present in consciousness at the same time and when several take place at the same time they are often in different degrees of objects of perception, and some of them may entirely escape observation. These experiences are so connected in consciousness that generally all are referred to the same object and are considered as belonging exclusively to the individual. During the course of a day, psychic experiences are enlarged into an uninterrupted series of sensations, emotions, representations, thoughts, and volitions. Analysis of these facts reveals three important properties of the structure of consciousness, succession, unity, and continuity.

b. Stream.—(1) *Definition.*—The stream of consciousness is the continual flow of psychic happenings, the continuous succession of

states and acts of consciousness. All psychic acts and processes of which persons are conscious form the content of this stream. The successive character of existence and action is the reason of the flow of psychic experience.

(2) *Constituent factors*.—The stream of consciousness is constituted by two factors, the continually changing content of consciousness comprising sensations, perceptions, thoughts, etc., and perception of this content and of its continual change. There is an immediate awareness not only of the content of consciousness, but also of its rapid succession in psychic panorama. The successive character of perception is the essential constituent of the stream of consciousness.

(3) *Unity*.—The unity of the stream is the organization of its constituent factors into a whole. The changing content and successive perception of it are not identical because the perception of it endures slightly longer, but neither are they two separate and therefore merely coexisting factors. They form an organic unit, because—

(a) The various experiences that form the content of consciousness are a unit among themselves insofar as they influence and condition one another in many ways. Thus, the vividness of content may inhibit development of a different one, and it may facilitate development of a similar one.

(b) Perceptive acts permeate and therefore connect all parts of consciousness and thus refer them to one subject.

(c) One knowledge embraces the whole stream of consciousness; it is the psychic experience of one person.

(4) *Continuity*.—The continuity of the stream is its uninterrupted succession. The threefold continuity in the stream is—

(a) *Function*. Consciousness is never empty. As long as conscious, an unbroken stream of objects and perceptions flow on.

(b) *Subordination of activities*. The higher activities of conscious life subordinate the lower ones to themselves and function at the same time with them. The sensations, representations, and concepts which a given object cause are simultaneous, not successive.

(c) *Interaction of activities and their products*. These exercise a reciprocal influence on one another. Concepts are not only abstracted from sensations or built up on other concepts and thus conditioned by them, but sensations are interpreted in the light of concepts and of the memories of former experiences.

83. Psychic development.—*a. Definition*.—Development of the individual's consciousness is the gradual actuation of his psychic

faculties. The use of the higher faculties is prepared by that of the lower ones. This preparation continues until the child reaches the age of reason when it can use its intellect and will. Origin of the higher faculties is nativistic insofar as all faculties are inborn, and it is empirical inasmuch as their exercise is conditioned by experience and the normal development of sensory organs.

b. Stages.—There are three principal stages of psychic development of the individual, psychophysical, psychophysiological, and purely psychic.

(1) *Psychological.*—The earliest stage is the psychophysical. During this period all psychic activities are directly dependent on the action of sensory stimuli on the organs. Hence, the causes of these activities proceed from the external world and from the periphery of the body. The psychic activities of this stage are sensation, feeling, and impulse.

(2) *Psychophysiological.*—In the psychophysiological stage man is independent of external stimuli, but he is still directly dependent on sense memory and imagination, and hence on the cooperation of the brain.

(3) *Psychic.*—In the purely psychic stage of his conscious life man possesses psychic activities that have no material components and of which cerebral processes are not intrinsic constituents. Thought and volition are the activities characteristic of this stage. But even in this, the highest stage of psychic development, man is still indirectly and immediately dependent on physical and physiological processes because his ideas are abstracted from sensations, and the latter come from sensory stimuli. The higher psychic activities now control the lower ones, and direct them to their own ends.

SECTION XII

UNCONSCIOUSNESS

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84. Nature.—Investigators have for a long time been familiar with the fact that there are mental processes lying outside the field of attention, or the threshold of consciousness. Schopenhauer's conception of "pure will" or "the conscious will," and the "universal unconscious" recognized the existence of a "force" which transcended consciousness and replaced the theory of Kant. Bergson's emphasis

on the fundamental distinction between instinct or impulse and intellect implies an unconscious. The same metaphysical principle underlies Von Hartman's view of the unconscious. Nietzsche, in his "will to power" attached even greater significance to underlying unconscious motives. The more modern psychologists, particularly the French of whom Janet is perhaps the foremost exponent, concede the existence of a subconscious in the sense of a lower level of consciousness, while Prince conceived the notion of a coconscious, an alternating consciousness. For Janet the subconscious has the same characteristics as consciousness, except that it is not integrated with the main stream of consciousness. The existence of a subconscious also is inferential and is deduced from automatic writing, hypnosis, or disassociation of personality.

The unconscious as understood by Freud is not merely a repository of old or forgotten memories and impressions which can be recalled at will or revived in hypnosis, nor a mystic universal force as stated by both Nietzsche and Schopenhauer, and more recently expounded by Jung. It is conceived of as a living, motivating, dynamic system of mental processes constituting the major part of psychic life, capable of independent existence within the individual, and exerting preponderant influence on behavior. The concept of the unconscious owes its origin to mental diseases because in normal mental life consciousness and personality are so well integrated that a subject can usually account for his behavior in terms of mental processes of which he is aware, and has no knowledge of mental activities other than his conscious ones.

If, however, consciousness and personality are weakened, actions may be determined by impulses that are not voluntary, and thoughts appear that are foreign to healthy experience. Such symptoms are held to be of unconscious origin. It might be said that if the personality-consciousness patterns were integrated to a theoretic perfection, there would be no unconscious at all; the subsidiary patterns would cease to have any expression separate from their contributions to the larger whole. However, even the most normal man experiences the effects of unconscious mental processes as, for instance, in emotion, and exhibits behavior that might be identically explained.

The unconscious provides the simplest and most adequate explanation for the peculiar behavior and emotions in normal man. The unconscious, which according to Freud draws its energy from inner processes, from instinctive impulses or cravings, among which those pertaining to sex or love life play a very important though not exclusive role, is capable of leading a life of its own in phantasy. The

unconscious, not having to deal directly with objective facts of the outer world as does consciousness, is not subject to limitations imposed by reality. It need not conform to the laws of logic nor submit to definite temporal limitations. Therefore, it does not reckon with time and admits of existence side by side of contradictory and illogical ideas and permits groups of ideas surcharged with energy or affect to remain unaltered for years and years. The unconscious may be said to be "archaic" and would act as such if it were not for the restraining influence of consciousness. Neither does it reckon with reality because it is guided by the pleasure-pain principle.

The ideas or groups of ideas deposited in the unconscious from early infancy and childhood are surcharged with an energy which constantly seeks outlet but cannot always attain it. It is this restlessness of the energy which gives dynamism to the unconscious and permits the unconscious processes to exert influence on conscious behavior. It was as the result of study of mental mechanisms especially as they appeared in the neuroses, by means of hypnosis, free association, and the analysis of dreams, that Freud reached the conclusion of the fundamental importance of the unconscious in the whole of psychic life of which consciousness is but a small part. It is the indirect expression or the symbolic expression of the unconscious ideas and impulses resulting in unexplainable manifestations or unaccountable general conduct, and it is this which accounts for the formation of signs and symptoms in the neuroses.

Jung considerably expounded the notion of the unconscious. For him there is a personal or individual unconscious and a universal or racial unconscious. The latter, or the collective unconscious, is supposed to contain memories common to the race, in certain instances peculiar to special races that are inherited impressions, repressed ideas, and much that is common to that race.

There is at present no general agreement regarding the class of phenomenon to which the terms subconscious and unconscious should be applied, nor is there agreement regarding the interpretation of these phenomena. Most concede that such things as nervous tics, mannerisms, and automatic writing are unconscious manifestations. In the more complex behavior of everyday life, there are also important unconscious factors such as motives. It is rare that an individual is aware of all the causes of his behavior. Important motives are frequently quite outside of consciousness. The problem of the motivation of behavior is thus in the main a problem of the unconscious.

According to this conception memory is based upon unconscious factors. Forgotten ideas are outside of consciousness, and when

remembered they are brought once more into consciousness. It is a fact that forgotten ideas are unconscious, but it remains a problem how they are conserved. Another illustration of an unconscious process is to be found in the intuitions or hunches so frequently experienced by persons. An intuition itself is conscious, but the cause of the intuition is outside consciousness.

Even perceptions may at times be unconscious. In other words, a situation may cause an impression to be registered in an individual without his being aware of it at the moment. Such an impression may later come into consciousness and the individual is then unable to account for its origin.

The causes of neurotic symptoms are usually unconscious and it is one of the tasks of the doctor to ascertain the causes. This is attempted through the various systems of analysis. Psychoanalysis as practiced by all authorities does not however imply that the unconscious causes of the nervous symptoms must necessarily be mental. These causes may be in the nervous system in the form of dormant neurograms or neural configurations. The process of analysis is a method of reactivating these dormant neurograms.

85. Neurological theory.—According to the neurological conception, there is no subconscious or unconscious mind. All unconscious processes are neural processes. Memories are conserved as neural traces or neurograms, and in remembering these dormant neurograms are reactivated. Similarly, the unconscious motives of behavior and the unconscious causes of intuitions and neurotic symptoms are of purely neurological nature. Such factors as neural energy, inhibition, facilitation, and organization are involved. In unconscious preception an impression is made upon the nervous system without any form of consciousness whatever. In automatic writing and other forms of dissociation the activity of the dissociated neurogram is not accompanied by consciousness. This theory has been referred to as “the theory of unconscious cerebration.”

86. Mental theory.—According to the mental theory, all the unconscious events and processes referred to above are nevertheless mental. Memories and ideas are conserved as such in an unconscious mind, and the unconscious causes of behavior, neurotic symptoms, and intuitions are likewise mental. There is considerable diversity of opinion among the exponents of this view. Some regard the unconscious mind as a fact, others as a hypothesis; some regard it as inferior to the conscious mind, others as superior; some believe it originates in the individual during his life time, others believe it racial in origin.

Some of the advocates have a decidedly mystical attitude. They may believe that consciousness is but a small emerging portion of a large sea of mind below the threshold. This subconscious mind constitutes a self which is often superior both intellectually and morally to the conscious self.

The most systematic exponents of a mental theory of the unconscious are the psychoanalysts, particularly Freud and Jung. Freud divides the mind into three parts: the conscious, the foreconscious, and the unconscious. The conscious is that portion of the mind of which immediately aware, the perceptions, thoughts, or feelings, of the moment. The foreconscious is outside immediate awareness, but can be brought readily into consciousness by such means as memory. The unconscious consists of those experiences and desires which cannot be brought into consciousness by any ordinary means. Psychoanalysis is one method by which the unconscious may be made conscious, by which forgotten childhood experiences may be brought again to memory.

The unconscious originates out of mental conflict. According to Freud this is primarily a conflict between these perverse sexual wishes of childhood and the conventional morality which the individual is obliged to acquire. As a result of this conflict, the original sexual wishes are repressed and a resistance is built up to prevent them from reentering consciousness. This defense is frequently greatly overdeveloped so that in consciousness there appears the opposite of the repressed trend. It is the task of psychoanalysis to break down this resistance and reveal the original wish. This conception of the unconscious is dynamic in nature. It consists of repressed childhood wishes which are ever striving to express themselves. It is also, as intimated above, sexual. The energy that strives for expression is sexual energy, referred to a libido. The sexuality of the unconscious is, however, a perverse sexuality. It consists of sexual cravings of childhood which cannot be lived out in adult life in a civilized or conventionalized country. Among the most important of these are autosexual craving or self love, homosexual craving or love of other persons of the same sex, incestuous craving or love of persons of the opposite sex within the same family, sadistic cravings or love of sexual cruelty and pain, and exhibitionistic craving or love of sexual display. These repressed impulses manifest themselves in various indirect ways for they cannot be completely annihilated. They express themselves symbolically in dreams, representing wishes which cannot be fulfilled in real life. They reveal themselves in mannerisms and slips of the tongue. They are converted or trans-

ferred into neurotic symptoms. It is the aim of psychoanalysis to remove the symptoms by laying bare the underlying causes and re-directing the repressed libido into other harmless channels. This redirection of the libido into socially more desirable channels is called sublimation.

Jung broadened the conception of the libido or sexual energy to mean the urge, push, or energy of life which is manifested in other desires and activities than the sexual. This libido has two opposing trends, progression, the striving forward toward differentiation and the overcoming of intervening obstacles; and regression, a pull backward toward the uniformity and irresponsibility of infantile and prenatal life. The libido may also be introverted, that is, turned inward upon the mental processes, or extroverted, that is, turned outward toward the external world. There are also in the unconscious mind archaic forms of thinking and feeling which hark back to prehistoric ancestors.

87. Psychoneurological theory.—According to the psychoneurological theory, unconscious like conscious processes are always neurological, but in addition they also may be mental. The term subconscious is used in a generic sense to include the unconscious and coconscious. By the unconscious is meant the purely neurological. It includes both dormant and active neurograms. The dormant neurograms are the basis of memory and have no mental aspect. Simple active neurograms have no mental aspect. They function in reflexes and in simple automatisms such as the more common mannerisms and of the less elaborate forms of automatic writing. Up to this point the psychoneurological theory and the neurological theory of the unconscious are identical. The differences arise in connection with the conscious.

a. Coconscious.—The coconscious is a coexisting but dissociated consciousness correlated with the functioning of the more complex dissociated neurograms. It has previously been shown that complex automatic writing may be due to the activity of complex systems of neurograms that have become temporarily dissociated from the systems which make up the rest of the cortex. It is contended that just as the main system of neurograms have a conscious aspect, so these dissociated systems may also have a conscious aspect. The active dissociated systems will have a conscious aspect if they are sufficiently complex, because consciousness is merely the subjective aspect of complex neural activity. The conscious aspect of such dissociated active systems is called the coconscious.

In a dissociated personality there may be two or more conscious systems just as there are two or more neural systems. The conscious-

ness that accompanies the major system of neurograms is called the main consciousness. The major system of neurograms is the system that is integrated with the motor neurones that control speech and locomotion. Consciousness may likewise accompany the other dissociated neural systems which thus become the coconscious systems.

b. Consciousness.—In addition to the unconscious, Freud conceives two other parts of the psychic system, all of which constitute what is generally termed psychic life. Within these is the vast field of the unconscious which contains all the ideas and groups of ideas surcharged with primitive emotion; without there is consciousness; in between there is the preconscious. Consciousness in this scheme is a sense organ which receives impressions from the outer world of reality and from the emotionally toned ideas of the unconscious. Consciousness then must reckon both with the world of objective reality and the world of subjective phantasy. Before ideas from the unconscious can enter consciousness they must pass certain controlling or resisting forces. If they cannot pass these forces they are shunted back again, repressed in the unconscious. To enter consciousness at all they must pass the preconscious. In this sphere exists ideas which may either be admitted to consciousness, banished to the unconscious, or remain in contact with both, all depending upon their compatibility with reality and their capacity to gratify desire, relieve tension, or avoid pain. The pain-pleasure principle may be said to hold good here as elsewhere in the mental economy.

c. Complex.—It has been said that in the unconscious exists ideas or groups of ideas deposited from infancy onward. When these groups of ideas are charged with various emotions, which they all are more or less, they are known as complexes. These deeply buried ideas tinged with affect or emotion influence conduct and determine behavior. If they become conscious they determine behavior directly; if they cannot become conscious, as is generally the case, they influence it indirectly. It is the presence of these unconscious complexes which explains bizarre conduct, peculiar actions, or unexplained points of view in otherwise rational beings. There are any number of complexes deeply buried that exert profound influences. Not all, however, are recognized and there are a number of others which most investigators refuse to recognize. Thus, one may readily understand the significance of the inferiority complex. The Oedipus complex is one which is disputed or not accepted by many workers. In general, it may be said that many complexes can be brought to the surface by means of analysis and superficial ones by association methods. The reasons why many of the deeply seated ones cannot

easily reach awareness is that they are in conflict with conscious tendencies or principles of reality. Not only is there the possibility of conflict between unconscious and conscious thoughts, but between opposing complexes as well. Unless one or another of these opposing complexes succeeds in reaching consciousness, the individual may waver between opposing tendencies, live in a perpetual struggle with himself, be unable to escape doubt or make decisions, and all action may become paralyzed. The fundamental significance of conflicts in psychopathology is that the struggle takes place in the unconscious. A conscious purposive conflict must be distinguished from an apparently emmotivated but in reality very significant, unconscious one.

d. Repression.—There must be some higher force which is capable of preventing unconscious ideas and complexes from reaching consciousness, and of compelling them to live independently in phantasy. If the conception of unconscious conflict is correct, some mental mechanism must be invoked in explanation of the phenomenon. There must be resistance to the emergence of the affected memories which are already in conflict and are apt to engender even greater conflict should they be allowed to come to the surface. The process of keeping them down is known as repression. The force which resists the recall of memories, of the unconscious wishes and strivings, is the same which causes repression. Everything repressed is unconscious, but it does not follow that everything which is unconscious is repressed. Repression should be clearly differentiated from suppression, which is a purposive exclusion of ideas from the field of conscious attention.

e. Energy.—(1) So much has been said about affective tone, about energy attaching to ideas and groups of ideas, of a force pervading complexes and capable of causing so much fermentation that the question naturally arises whence comes this energy. The answer to this depends upon one's point of view and the formulation of one's theories. Some speak of a universal force, others of a soul, a conscious, etc. McDougall conceives of a specific affective tone which accompanies every instinct. Thus fear is the affective energy of the instinct of fright, etc. He pairs every instinct with an appropriate emotional reaction which gives it propelling force. He derives the affective tone from primary instincts and combines both the emotions and instincts into complex sentiments with their variously compounded emotions. This driving power or purpose behind the action of the instincts determines behavior and accounts for departure from normal adaptive reactions; this is what makes McDougall's psychology dynamic.

(2) The endocrines have been advanced as the source of the driving power of the instincts by the physiologists. Psychoanalysis too maintains that the affective energy is derived from primitive impulses. This is spoken of as the libido. Freud, however, applies the term only to the energy derived from sex impulses, from the instincts of procreation, in contradistinction to the energy derived from the ego impulses or instincts whose immediate task is the preservation of the individual. This psychic sex energy, or hunger of the sex impulse, differs from other forms of psychic energy. It is an energy within the individual's unconscious and not, as with Jung, the universal vital energy whose general teleologic purpose is adaptation and whose failure to surmount obstacles leads to more primitive ways of adaptation. By libido is understood the craving for satisfaction of sex instincts, just as hunger and thirst satisfy needs of growth or metabolism.

(3) This psychic energy pervades the unconscious, is conceived of as capable of attaching itself to ideas and groups of ideas or complexes, of investing parts of the body, of being arrested or fixed at certain periods or stages in development of the infant and child, of floating freely within the unconscious, of turning in upon itself and clinging to the ego, of being projected outwardly and attached to objects or persons, and of turning back or receding to previous levels.

f. Fixation.—(1) *Definition.*—Attachment of the libidinal energy at certain stages of development of the individual or undue intensification at those periods and its failure to progress from stage to stage is known as fixation. That is, there is an arrest of the impulses at various phases of development, and the points at which such arrest occurs are known as points of fixation. From investigation of unconscious mechanisms of neurotic symptoms, these points of fixation have come to be regarded as representatives of phases occurring normally in development of the libido.

(2) *Phases.*—The first phase is known as the oral, immediately following is the anal. Both are pregenital, and represent auto-erotism and are related to nutrition and excretion. The anal phase is conceived of also as the sadistic and the urethral as the exhibitionistic. Following these appears the genital phases with the supremacy of the procreative organs and their investment with libido, which can henceforth develop into the adult or mature form, as happens ultimately at puberty. The very earliest phase when the whole body or ego is invested with the libido is known as "narcissistic" or more generally, auto-erotic. This condition has been compared to sleep in which the libido is withdrawn from the outer world or objects of reality, and directed to the body itself. That phase of the libido which is

directed to bodily organs becomes the ego-libido, while the energy directed to outer objects or persons is known as object-libido. Withdrawal of object-libido and its introversion, its turning upon the body or self, converts it into narcissistic libido. Finally, the ability to shift the object-libido, or to transfer it from one person to another, is known as transference.

g. Regression.—The theory of the conception that there are numerous developmental phases of the libido and that points of fixation exist in the unconscious is important, because the theory of regression is intimately bound up with it. By regression is meant a return flow of the libido to earlier points of fixation whenever outer or inner conflicts make adjustment to reality difficult or impossible, and necessitate a return to phantasy life or to simpler modes of adaptation. It is a psychic process away from unpleasant adult adaptation to the easier, less complex, and more secure existence of earlier life. Normally, the adult is capable of overcoming obstacles even at the expense of suffering. If this becomes too difficult there may be temporary or partial hurdling of the difficulties and partial regression. When there is total inability to resolve conflict, overcome obstacles, or face reality, there is complete regression to lower levels of adaptation.

h. Censorship.—Referring again to the power which reviews the admissibility into consciousness of ideas seeking entrance from the unconscious, this guardian of conscious reality is conceived of as having the power of rejection, of standing sentinel, and of deciding on the compatibility or incompatibility of primitive thoughts or impulses with higher standards of ethics or morality. In this is embodied the notion of the "censorship", admittedly a figurative, hypothetical, but none the less very useful one. The censorship idea is invoked most commonly in the interpretation of dreams when the censor is supposedly asleep and least effective. But many of the complexes which strive to but cannot reach consciousness directly because of the resistance of the censorship or conscious ego may and often do find outlet by disguising themselves in some acceptable form. Many are the disguises devised by the libido to elude or deceive the censorship, and a number of concepts have been introduced to explain the unconscious mental mechanisms. Whatever the devious way may be or peculiar disguise adopted to pass censorship and avoid conflict, strange behavior or curious conduct are thereby made possible.

(1) *Displacement.*—It sometimes happens that the emotion or libido energy is attached in the unconscious to an objectional idea which cannot become conscious without causing painful conflict. The energy

then becomes detached, dissociated from the objectional idea, and is shifted or transferred to another which can pass muster. This is known as displacement of affect, a mechanism commonly employed in the formation of dreams and not infrequently in certain forms of wit. In such instances one finds unconscious thoughts represented by indirect illusions.

(2) *Projection*.—Occasionally, a repressed idea or complex is regarded as belonging to someone else. This mental mechanism is known as projection, and involves shifting on to others hidden fears and wishes peculiar to self. In its extreme form projection gives rise to delusions characteristic of the insane. In some of its phases jealousy illustrates a simple instance of projection, and attributing to others weaknesses personally possessed is another illustration of the mechanism.

(3) *Dissociation*.—As a refuge from conflict deep-seated complexes often are withdrawn into what may be termed logic-tight compartments. This results in the mechanism known as dissociation, and permits the existence side by side of generally incompatible and sometimes diametrically opposed ideas. The utter inability to appreciate in one's self what is so obvious to others because of the unconscious nature of the thoughts or the motives for action explains the peculiar behavior which is commonly observed in otherwise intelligent beings. This explains why a religious physiologist accepts the immaculate conception. Indulgence in contradictory ideas is not necessarily a sign of lack of intelligence.

(4) *Rationalization*.—Another mental mechanism in a measure akin to dissociation, at times the result of it, is that known as rationalization. Actually this is a process of self-deception by means of adventitious reasons in order to give at least the semblance of logic or plausibility to ideas and actions which are otherwise contradictory. Here too the process arises as a result of repression, or need of avoiding conflict which must necessarily ensue from clash of opposing emotions. Rationalization is so universal a process that it may be considered almost normal.

(5) *Conversion*.—As a further refuge from serious conflict, it sometimes becomes necessary to repress libidinal energy very effectively and to banish it deep into the unconscious, or, rather, to low somatic levels. In this way the dissociated affect is disposed of by becoming attached to bodily organs. The mechanism is known as conversion, and is seen to be operating in manifestation of neurotic signs and symptoms.

(6) *Ambivalence*.—The existence at the same time within the unconscious of ideas or complexes charged with opposite emotional tones is known as ambivalence. This concept attempts to explain the simultaneous possession with regard to individuality such opposing affective reactions as love and hate, etc. In such cases it is assumed that for unconscious reasons there is a shifting to and fro of the emotional charge from one idea to its direct opposite. There may be a compromise formation in which there is partial gratification of conflicting emotional tendencies. The instinctive impulses thus find some outlet without conscious recognition of the fact. A more or less universal phenomenon particularly characteristic of certain types of neurotics is the mechanism which goes under the name of identification. The root of this traces back to early life when the child naturally sees itself in the image of the parent, generally of the same sex.

(7) *Reaction formation*.—As the result of repression, there is the mechanism known as reaction formation. In effect this is a function of many of the mechanisms previously defined. Actually it consists of the detachment of the affective tone from one set of ideas objectionable to the conscious ego and its shifting to another opposite group which is not objectionable. This too is a substitute process; but as it also manifests itself in over-reaction in an overcompensatory way, the mechanism becomes one of compensation.

(8) *Use and purpose*.—Practically all the mechanisms considered had to do with repressing tabooed ideas and keeping the original primitive impulses incompatible with conscious thought or facts of reality from coming to the surface. Essentially their purpose was to avoid conflict. When the repression was successful, normal adjustment resulted; where repression was unsuccessful, neurotic manifestations came to the fore. In many instances also as the result of repression and in the interest of avoiding conflict, the primitive energy derived from sexual impulses is shunted away from its sexual objective and directed to asexual and socially useful aims. The process involves substitution of socially acceptable objects as a means of vicariously gratifying impulses.

i. Dreams.—The unconscious strivings considered have been represented as primitive wishes which seek gratification in one way or another. As reality does not always permit it, they find outlet in phantasy. Therefore all phantasy life is said to be characterized by those wishes. Among the numerous manifestations of that life, the dream represents phantasy in its purest form. In the contents of the dream therefore one may see displayed practically all the

manifestations of the unconscious, gratified and ungratified wishes, the successful and unsuccessful results of repression, all the primitive psychic impulses. From the point of view of psychoanalysis the dream is conceived of as a form of hallucinatory gratification.

SECTION XIII

AFFECTIVITY

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88. Scope.—The old popular saying, "There are two sides to every question," holds true of thought also. Mental activities of all kinds have two sides, an intellectual and affective or emotional. While the affective component is often denied conscious recognition, it is always there. Usually it is denied its true evaluation for man insists on flattering himself that he is a logical animal. His ego demands that he delude himself into believing "I govern myself according to logic and reason, my emotions and personal feelings play a minor part in adjusting to the situations of life." In reality the affective quality of the thought, percept, idea, judgment, belief, or action is usually the dominant factor. In meeting and adjusting to the situation of life there are two parallel processes which are active and influence conduct, conscious mentation which influences conduct directly, and unconscious mentation which influences conduct indirectly. Consciously logic or reason are presumed to govern, but the unconscious mentation which is crudely symbolistic and primitive has great influence on actions. It is quite impossible to have these two parallel thought processes functioning simultaneously without one influencing the other. The pleasure-pain motive motivates whether consciously realized or not.

The emotions with their consequent feelings of pleasure and displeasure are all embraced by the term affectivity. The term feeling or emotion is too limited to be used instead of affectivity. Feeling may be a mere sensation of warmth, cold, roughness, or more complexly a feeling as though someone were near, these being merely

component parts of the total, affectivity. Then again the term feeling may designate some more complex process of the unconscious like a woman's feeling or intuition, again merely a part of the affectivity. When a beautiful flower is observed it gives a vague sense of pleasure, but it does not cause rhapsodies of euphorism. It is merely a small part of the general whole of the sense of well-being, or the pleasure and zest of life. All that is embraced by the pleasure-pain principle of Freud is included in affectivity.

Affectivity, therefore, is broad and far-reaching in its scope and includes somatic as well as psychic manifestations, physiological as well as psychological effects. There may be symptoms as well as affects, so affectivity certainly has strong influence on physical relations, yet physical conditions markedly influence affectivity. The plethoric old gentleman with a gouty toe is not synonymous with a shrinking violet disposition; the alcoholic displays euphoria or depression; the dyspeptic is irritable; the endocarditic shows anxiety. Thus the influence which physical conditions have upon affectivity is seen.

89. Actions.—Actions are largely determined by affectivity. Since a pleasure-pain principle is the governing motive of life, there is striving to gain pleasure and to retain it. To do this the pleasurable experiences are sought and the unpleasant and displeasurable ones avoided. The unpleasant is minimized and the pleasurable is enhanced, perhaps by contrast. Hence when something unpleasant and distasteful is done, it is either to gain some pleasure that overcompensates for the previously assumed displeasure or it is to avoid still greater displeasure. The first is positive, the latter negative, yet both conform to the pleasure-pain motive. No species has long survived in the struggle for existence that habitually sought the unpleasant things of life.

90. Thought.—Just as our actions are influenced by affectivity, so also is thought, and to a much greater extent than is ordinarily acknowledged. As a result of the dominating force of the affects, the threshold for its associations is lowered, while contrary and incompatible associations are inhibited or repressed. A man with a hobby rides it until it becomes an emotionally accentuated subject. There is a compulsion to this overaccentuated hobby which causes him to see references to it in the most casual statement. It may become a fetish and occupy a place in his life entirely disproportionate to its reality value. It causes him to falsify his logic and perhaps deprive himself of material sustenance in order to spend his means to further this hobby or obsessional idea. He ignores or

belittles its weak points and chances of failure and dilates at great length on its value and its certainty of success. The values related to the affect or hobby are unduly enhanced, while opposing ideas are considered negligible or irrelevant. The overtimid man does not learn to fly for the reason that he overaccentuates the dangers involved and underestimates the chances of success. The euphoric hypomanic usually kills himself because he is unable to take into account any contingency of failure. He ignores all hazards or does not think of them so positive is he of his own ability. All things are possible to him, notwithstanding his mediocre endowment and lack of training. Darwin had to jot down carefully in his notebook all contrary comment and criticism, yet he remembered perfectly anything that corroborated his theories. This is again the pleasure-pain motive, the result of affectivity on thinking.

Affectivity comprises many component parts, its affects have many and varied significances and variations, manifesting themselves in polychrome effects. The expression of the affect may come from a general mood such as euphoria, depression, anxiety, or may emanate from a single affective idea or from a complex. This is especially marked in abnormal psychology. One can be in a general mood such as gladness, and yet have an underlying complex either conscious or unconscious of a differently toned affect such as anxiety or fear. This point can be illustrated by a patient with an anxiety neurosis. Although the mood is one of anxiety, he can be made to laugh at a joke. In this example, although the prevailing affective shade is one of gloom, the bright associations aroused momentarily by the joke are dominant for a short while as an affect of merriment. However, these are soon again overwhelmed by the prevailing affective mood of anxiety. If some person is disliked, one is quite prone, even anxious, to believe any evil rumor heard about him. Thinking may be quite social in all other respects, but is very one-sided in this regard.

91. Relationship.—*a. Complex.*—Because of the affective coloring of complexes there is a constant tendency toward a correlative relationship between complexes and other experiences. Experiences which have only the slightest degree of relationship by this bond of affectivity are bound into the same complex bundle. The shrinking, acutely self-conscious man suffers agony when exposed to the public and, because of his inferiority complex, endeavors in all ways possible to avoid the spotlight. Should he drop a bundle or lose his hat on the street he imagines that everyone is staring and laughing at him. This complex affect may become so intense that he develops

ideas of reference, believing that people on the street stare at him unduly and later make derisive remarks about him. This condition may become so accentuated that it motivates conduct, thereby causing a psychic maladjustment necessitating confinement in order to protect the herd. This type of individual always has the heroic Gargantuan phantasies or daydreams as a compensation for this overwhelming inferiority complex. In this class are often found the type of person who always yields on important matters, but who is very obstinate, pettish, and mulish about trifles. Here is found the meek and hen-pecked husband whose spouse plays the dominant role, but as a compensation he may be the parent of a numerous progeny as an unconscious protest against his inferiority complex and as a visible demonstration of his virulence and potency. Although the complex may be split off from consciousness and repressed into the unconscious, it still retains an influence upon the psyche and motivates conduct.

b. Spread.—It has been said that the influence of affectivity upon thought and action becomes reenforced by its tendency to spread. The affect will continue long after its intellectual basis has ceased to be operative, and will extend to other psychic experiences and give them an affective shading. The affect of fear, anxiety, and depression may continue for so long a time that it becomes the habitual mood of the person. Affectivity once activated tends to persist, to become transferred to other thoughts and experiences, and because of its influence upon the mode of thinking may become a permanent mood. In this relation, physical causes and the psychic personality must also be considered as contributory factors.

c. Tempo.—When elated all the processes travel at a faster tempo. The train of thought as well as action is accelerated by pleasurable accentuated affects, while unpleasant or painful affects slow down the tempo. The acceleration may be too great and become pathological as seen in the manic phase of the manic-depressive psychoses, or the slowing down may become too excessive and the depressed phase of the same condition results. These facts are universally recognized throughout the business world. Happy, contented employees who are safeguarded as much as possible make for increased output of work and greater efficiency. When conduct is motivated by painful affects there is depression, and psychic and motor activity is slowed down. A man may become so depressed that he merely sits around and mopes and produces nothing, either mental or physical.

d. Associative power.—Affects, because of their emotional strength and prominence, show great associative power and everything of even the slightest emotional relationship is given the same affective shade. An affect shows a marked tendency to ecphorize former affects of even slight similarity. This is the reason that the precipitating cause given by relatives and friends for the onset of a psychoneurosis or psychosis is often so disproportionately trivial to the severity of the psychic maladjustment. The exciting event while not important in itself acts as an outlet focus for the formerly repressed affectivity. It is "the straw that broke the camel's back." This result is produced because the incident, by reviving affects from former experiences of similar quality but of a much greater emotional tone, produces an affective flood which overflows the psychic repressive dam of conventionalized conduct. By the associative power of the affects there is drawn together in one complex ideas of similarity while dissimilar ideas are repelled or inhibited. In this way affectivity exerts a limiting influence because it determines the form and content of complexes. Ideas of experiences that are compatible with the affect of a complex are promptly utilized and absorbed because of this association readiness, while incompatible ideas or experiences are rejected for this particular complex by the negative pole of the association readiness which is association hostility. This is why complexes are usually unconscious, and also why unpleasant affective tones are so frequently repressed into the unconscious. The pleasure-pain principle separates like from unlike and ego demands that the pleasant predominate and be the guiding motif.

Thus, because of the associative power, affectivity has a formative function. By means of association readiness ideas of a similar emotional tone are drawn together in bundles or groups or constellations, and by means of associative hostility amalgamation of incompatible, dissimilar toned ideas is prevented. It is in this way that the compact dynamic complex is formed and kept growing. It constitutes a very important attribute of affectivity, for complexes dominate lives and shape personalities.

92. Complex.—*a. Scope.*—A complex may be formed or connected with almost anything, but its scope will be illustrated most easily by a personal complex. If one person has crossed another, everything connected with that person is tinged with unpleasant feeling, this affect of unpleasantness coloring all associations between them. Both the association readiness and the association hostility are brought into more or less active use when any idea or experience arises which in any way reminds of this unpleasant person. Someone else is met who

vaguely reminds of the unpleasant individual and immediately a defensive antipathy toward the stranger is developed. Vaguely distrusted and disliked are all people who are in the same business as the displeasurable person. If another speaks well of him, the commendation is resented and estimate of the speaker is lowered. People with the same or similar mannerisms are received with reserve and coldness. The repression may be even stronger so that the whole complex is consciously forgotten, possibly making it difficult to recall even the names of his associates. Thus the complexes may exist either very vividly in consciousness, or when repressed, in the unconscious. However, they do exert a powerful influence upon thinking, actions, strivings, and beliefs.

b. Dominating.—The dominating complexes are usually closely connected with the instincts because major struggles or conflicts result from efforts to satisfy these instinctive drives and desires, and at the same time maintain a satisfactory adjustment to demands of the herd (modern society). These complexes are usually rather easily recognized in the general attitude and behavior of the individual. Complexes of this type are usually ambivalent. Ambivalence may be considered as a double edged-sword both useful and dangerous, illustrated in the following examples which consider the two extremes of the ambivalent inferiority complex. One type of person who feels his inferiority never has a mind or will of his own and is swayed and guided entirely by the directions and opinions of others. He is unable to come to a positive conclusion or to make a decision in the face of adverse criticism. He believes the ideas of others to be superior to his own, and continually strives to please everyone; he is negative and passive, a mere sounding board for his associates. On the other hand, Napoleon is an excellent example of a personage with a positive reaction to his inferiority complex. To combat his innate feeling of insufficiency in a positive way he always strove to elevate himself, to be superior to all peoples, situations, things, and circumstances. Thus it will be seen how great is the affective influence on the thoughts, actions and life of an individual. Depending upon the tone of the affectivity of the dominant complexes, an individual's life is either positive or negative, destructive or constructive, good or ill, conducive either to success or failure.

93. Process.—The following quotation is self-explanatory: "An intellectual process, a perception, an action in response to a stimulus are all in a certain respect partial functions." It can be imagined that only a part of the psychic organism participates in these processes. In contradistinction to this, the affective processes signify an

assumed attitude of the whole person. They participate in the affective changes of all psychic activity, in the creation of a uniform striving. Intellectual and affective activities are related parallel manifestations; they represent the two sides of the same process. Nevertheless, they can subsequently separate so that each process may proceed independently or become associated with processes of another series. As a result of irradiation, an affect may become connected with ideas to which it was not originally related and still remain in contact with the original idea, or it may be separated completely from it. To illustrate, a distinct image may be formed of the death of a beloved person without experiencing with it the usual affect of grief, the painful affect, having become separated from the thing that originated it, has attached itself to some object or thing closely associated with the individual before death or possibly something connected with the funeral as, for example, a song or the place where the person was seen last alive. This displacement of affect is frequently not understood and is responsible for many strange and unnatural feelings so common in psychoneurotic individuals. The affect may become detached from the original idea and not attach itself to any other idea; there is then a freely floating affect. The affect then may remain attached to the original situation or idea, it may become attached to other ideas, or it may become unattached.

94. Psyche.—*a. Formation.*—A consideration of affectivity shows that it is not the individual affect but the psyche as a whole that is always the decisive factor in our lives. The psyche itself is shaped and moulded by the various affects, ideas and percepts, and no individual affect is superior to the whole. All affects are necessary to form the whole psyche; although some may be predominant and of more importance than others, they are subordinate to the whole machine, the psyche. One may be very fond of a certain table delicacy, but if too much is consumed and illness results, after recovery it is looked upon with repugnance. The former pleasant affect is transformed into one of unpleasantness and perhaps of an actual physical distaste. When a man is poor and lowly he may be delighted with simple pleasures and unassuming friends, but after he attains wealth and position, the pleasures and friends of former times too often bore him and grate upon the aesthetic sensibilities engendered by his change of social status. An intoxicated man may make unpleasant or insulting remarks and they produce either no affects or only small ones. However, should the same man while sober make the same remarks, the affects produced are of an entirely different char-

acter. It can then be said that reaction is never to a single stimulus, idea, or experience with a single definite affect. The result produced is a part of the multitudinous reinforcing and counteracting complex of functions and affects comprising the psyche.

b. Neutralization.—Opposite affects tend to neutralize one another insofar as achieving expression in their original form is concerned, the negative conflicts with the positive, the civilized conventional with the primitive and savage. The Oedipus complex, although universal, is unthinkable and intolerable to the average person, so it is repressed and finds its expression in a sublimated form acceptable to society. However, actions and lives are influenced by it just the same and the voice from the unconscious is heard even though dimly. One man may find his sublimation (and reach an adjustment) by retiring into the peaceful cloistered bosom of the church; no woman can displace his repressed incest longing; there is no satisfactory substitute. Another man becomes a roué, a Don Juan, constantly, pursuing the will of the wisp, the perfect woman. She is always just ahead, or she is bound to someone else and therefore is unattainable. He can find no acceptable substitute.

c. Domination.—Reaction to a single experience is never with a single definite affect. When two affects are aroused by a situation, one of them dominates and more or less minimizes the other. The minor affects are used as a sort of supporting background. If a man is slapped by another, he feels pain, fear, and anger. This unpleasant stimulus at once arouses in his psyche an emotional apparatus with physical concomitants which seek to avenge this insult. Should the impulse with this affect of vengeance become physically active, it is satisfied. He has revenged himself; therefore, the apparatus aroused by the unpleasant stimulus is now shut off because it has accomplished its purpose. The anger at the insult was the dominating affect while the affect aroused by the physical pain from the blow was a minor affect which acted as a supporting factor and produced a desire to inflict physical pain in return. Fearing that he might again be struck, he in turn strikes a much harder blow. This harder blow is given to revitalize his own self-esteem, which was grievously wounded by the insulting slap, to make fear of himself the chief affect of the other man in his regard for him and to assuage his instinctive haunting fear that perhaps the other man is more virile and potent. In this as in everything else colored by affectivity, in every phase of life, the Freudian-pleasure-pain principle governs. The unpleasant stimulus may be made a source of pleasure in that it enables conquering and proving superior to it.

d. Motive power.—(1) *Abreaction.*—From the above it can be seen that the affect has a motive power, an activating force causing various and varying segmental tensions which might be compared with the physical tension of energy. If the tension generated by the stimulus is too weak to force an outlet of expression or if it is restrained from an expression, then the apparatus and its tension must necessarily remain inactive. But if new and similar stimuli are received these add more and more tension, reenforcing the original until finally it is so strong that it cannot be denied expression. Due to this accumulation of affects there may be a qualitative departure from the original purpose of the affectivity and it may be given a form of expression that is extensively and intensively beyond the original aim. Suppose a man has had a hard day at the office. His superior has reproved him, and he could answer nothing to this reproof. He had to swallow his wrath, humiliation, and chagrin, to suppress these affects without expression. He goes home at night grouchy and irritable, not having been able to express his resentment against his superior. He is now a smouldering, glowering volcano of wrath, awaiting only a favorable opportunity to overflow and overwhelm a suitable substitute with his psychic pyrotechnics. When he gets home his dinner, no matter how appetizing and tempting, does not suit him and his wife may chide him, thus adding fresh fuel to the fire. However, his moral and conventional training are such that he may not give vent to his surging wrath by striking his wife, and his conventional repression may be so strong that perhaps there is even no wordy outburst of resentment. If now the inoffending household cat crosses his path and gets in his way, he kicks the cat and swears at it feelingly. He then feels better and is more at peace with the world. There has been a discharge of the affective tension, an abreaction. This tension has been so lessened that the psychic apparatus, first aroused by the original stimulus and kept growing by succeeding stimuli, has been dismantled and its force spent and dissipated. Uncontrolled children who have been repressed or restrained by their elders often abreact their affective tension by lying down on the floor, kicking their heels, screaming or by slamming their toys about.

(2) *Accumulation.*—If the psychic apparatus with its surcharge of affectivity is not disfunctioned, is not abreacted, it remains alive, tense and dynamic and causes in normal people an incomprehensible readiness to explosive reactions to certain stimuli; in other words, they are especially sensitive or touchy to certain experiences. Who does not fit into this class? In people with abnormal psychic personalities this accumulated affective tension apparently loses none of

its force and energy through its imperfect ab̄reactions, but it grows continually by many and varied stimuli so that the tension is constantly just at the breaking point. This is caused by the constant repression. The affective complex may become so strong that it cannot be denied conscious recognition and is kept actively growing by new stimuli. Thus the hypersensitive self-conscious man is constantly having new experiences which accentuate his bashfulness and timidity; he is continually on the lookout for these sensitive stimuli. The greater portion of his psychic energy is devoted to perfecting his defense mechanisms against his inferiority complex. Although the germinant of this complex is unknown to him, the complex certainly motivates his life and conduct.

95. Degree and tension.—Of course the degree and tension of affectivity varies greatly in different individuals and in different ages in the same individual. While every normal person must call a cigarette a cigarette and observe the general laws of convention and logic in order to get along with the external world in general, he may consider the cigarette as a mere harmless, pleasant indulgence or a device of Satan designed to destroy the bodies and ensnare the souls of his fellow beings. Thus true logic has nothing to do with the affect-tone which governs reactions, though the affectivity is usually clothed in a garment of specious logic.

96. Character determination.—Character, according to Webster, is "the combination of qualities differentiating any person or class of persons." Therefore, affectivity largely determines character. The following quotation is self-explanatory: "Animated and easily changeable feelings constitute the sanguine temperament, while persistent and profound feelings the phlegmatic character; a person who does not accentuate the concepts of good and evil with pleasure and displeasure, or who puts a weaker accent on them than on egotistical ideas 'has a bad character.' Next to the quality of the reactions we must also consider the rapidity and force of the affects and hence of the empulses. Jealousy, envy, vanity are characteristics as well as affects. Affectivity is also responsible for laziness, energy, steadiness, diligence, and carelessness."

97. Functions.—The functions of affectivity are very broad and govern and shape psyches. Actions, their force and direction, uniformity, emphasis, and coherence of purpose are governed by affectivity. The pleasure-pain principle dominates all for it regulates social intercourse with the herd. All constantly strive for the pleasurable and avoid the displeasurable. In striving for existence and supremacy the pleasurable is usually what is most useful for the individual

organism or to the herd as a whole. While it may not be the most pleasurable at the present moment the allure of future rewards says that the present unpleasantness may be the means of future pleasure, so the present sacrifice in that sense becomes commendable and therefore a pleasure. Affectivity and its complementary other self, the pleasure-pain principle, might be said to be the real psyches, the boasted individual personalities.

SECTION XIV

INTELLIGENCE MEASUREMENT

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98. General.—*a. Scope.*—This section is concerned with the differences in the characteristics of individual human beings. In any study of the differences in people, methods of measuring are of first importance. Work in individual differences puts a heavy strain on experiment. It is easy to work to averages or tendencies only as in general or type psychology, but it is not nearly so easy to measure differences between individuals for any one variable or type. As an example, it is easy to work to types such as extrovert or introvert, but extremely difficult to measure various degrees of either. In quantitative terms degrees of difference in traits possessed by individuals must be dealt with.

b. References.—The material for this section has been taken from Rudolph Pintner, "Intelligence Testing," Yoakum and Yerkes, "Army Mental Tests," A. I. Gates, "Psychology for Students of Education," L. M. Terman, "The Measurement of Intelligence," Yerkes, Bridges, and Hordwick, "Point Scale for Measuring Mental Ability."

99. Historical sketch.—*a. Work of scientists.*—(1) *Development.*—(a) The science of man is of such recent development that it has not as yet fully established itself. Until recently the taboos of religion and lack of methods discouraged the study of man as a growing, living, and social organism. At the turn of the century a reversal of attitude took place, and now an ever increasing number of scientists from different schools are concentrating their efforts on the study of the human being, and as a result are accumulating a wealth of factual and experimental material from which may come changes not only in the conditions of human life, but also in the social and personal characteristics of the individual himself. The recent work in human measurement done by scientists will fill volumes.

(b) There was considerable work done in mental testing prior to the period 1898-1908, when Binet did his pioneer work in this field. These early tests were characterized in greater or less degree by several points of approach which have since been found to be unsound; that the mind can be measured by testing a number of relatively simple sensory motor reactions, for example, counting dots; that mental life can be analyzed into rather distinct mental functions, for example, memory, etc., based on the point of view of the older faculty psychology; that even were the existence of such functions as mental entities to be granted, the arbitrary assumption of the test constructor was deemed sufficient to establish the validity of his test as an instrument of measurement of the function considered. Almost the only criterion on which these tests depended for their validity was armchair analyses of the mental processes which arbitrarily were supposed to be measured by the test; that is, in each test the constructor was guilty of a "naming fallacy," or in other words, he would decide empirically that his test was a measure of memory, reasoning power, imagination, perception, and other separate mental functions.

(2) *Binet.*—Alfred Binet first held that intelligence is revealed in situations calling for the use of many mental functions at once, and that complex mental processes must be tested, for only in them are variations found important enough to differentiate human beings intellectually. Binet decided that the attempt to disentangle intellectual processes into simple component elements was futile as an approach to the measurement of general intelligence since it was in their combined functioning that the efficiency of the mind should be tested. The concept of general intelligence was thus developed as against the concept of separate mental function.

Binet in his final studies stressed three aspects of intelligent behavior; ability to take and maintain a given mental set, capacity to make adaptations for the purpose of attaining a desired end, and power of auto-criticism, or recognizing and correcting one's own mistakes. After experimenting over a period of years from about 1898 to 1905, in the course of his attempt to find tests which would differentiate bright children from dull children, or in other words, to test this general intelligence, Binet and his coworker, Simon, set up two procedures: First, they worked out standards of intelligence by obtaining the opinions of parents, teachers, and friends as to the individual brightness or dullness of a group of children; by systematizing these judgments they obtained the first "criteria of intelligence." Second, they collected lists of questions on everyday topics and simple tasks, all of which they could assume as being part of a child's experience. These they arranged in groupings according to the experience common to each year of a child's life, beginning with the age of three. After much experimentation, Binet established the fact that differences in stages of mental development as represented by the performance of children at various ages are closely connected with differences in intelligence as judged by responsible observers.

b. Modern tests.—(1) *Development.*—(a) *Origin.*—Modern mental testing may be said to have sprung from Binet's two ideas. Instead of checking against empirical assumptions, objective criteria of general intelligence must be employed, and all individuals classified by a standardized test with reference to a group must have shown a background of common experience such as obtains in a home, the school, and other cultural media. Since the original work of Binet, there have been reported 68 revisions of the scale.

(b) *I. Q.*—The yearly increment scale gave rise to the concept of mental age, that is, the age at which a certain portion, usually about 75 percent, of the children on whom the test was standardized can first complete a given task or set of tasks. Hence the intelligence of an individual can be gaged by comparing his responses with standards of performance for normal children of his own and of different ages. Upon this basis of mental age in relation to life age was derived the I. Q. first proposed by Stern of Germany. The I. Q. is not a score in terms of tasks done, but a ratio between a child's actual performance expressed in terms of his mental age or M. A., and his own chronological age or C. A. Thus it will be seen that the I. Q. always being a ratio between two expanding variables does not necessarily change or fluctuate from year to year.

(c) *Army*.—Following the publication of the Stanford Revision by Terman in 1916 mental testing was employed widely, particularly in institutions, immigrant stations, juvenile clinics, public schools, and courts. During the war a group of psychologists were called on to develop scales to measure soldiers inducted into service. The result was the Army tests, Alpha, a verbal test for the literate and Beta, a nonverbal test for the illiterate. These Army tests and their later revisions and modifications gained wide use. In addition, more and more performance and other nonlanguage tests appeared.

(d) *Verbal groups*.—In the 1920's verbal group tests appeared by the dozen, mostly for use in schools and industrial establishments, and not all of these tests were constructed or standardized with adequate care. Tests were soon given by the expert and the nonexpert alike. As a result much just and unjust criticism was directed against all tests.

(2) *Use*.—At present, mental testing is slowly recovering from the false impetus it received from the misinterpretation of results and the enthusiasm of misguided users of test materials. Unqualified assertions about the I. Q. are becoming rarer; it is recognized more and more that the influence of different backgrounds, social and educational forces, and other such factors must be taken into account. The most hopeful signs for the future are a constantly increasing caution and a statistically painstaking care in construction and validation of new tests; a new insight into the matter of interpreting scores coupled with a general lack of confidence or a caniness in not accepting any standardized test merely because it has worked its way into print and been offered for sale.

100. Intelligence.—The geneticist or the sociologist who wishes eventually to measure innate ability must be in touch with the intelligence theory. He must be acquainted with the controversy as to whether intelligence is general or specialized since this has a vital bearing on his researches into mental heredity. Even though mental tests may have proved useful in measurement of general intelligence, it does not necessarily follow that they can accurately measure mental traits as the units through which the laws of heredity would operate.

a. Definition.—(1) Intelligence has been defined as follows: "Intelligence is a general capacity of an individual consciously to adjust his thinking to new requirements; it is general mental adaptability to new problems and conditions of life."

(2) From a neurological basis, it has been defined: "Intelligence is a biological mechanism by which diverse impulses are brought to-

gether and given a somewhat unified and consistent effect in behavior. These impulses are, of course, the results of stimuli of various kinds."

(3) One authority recognizes that individual differences in "degrees of intelligence are determined by the general capacity of the psychophysical organism for the formation of new patterns among the elements of experience."

(4) Some workers confine their concept of intelligence to something which is measurable. The contributions to knowledge of the growth and development of intelligence made by Terman, Thorndike, Pintner, and many other workers with tests have been on the assumption that individual differences in innate intelligence can be ascertained by scores on intelligence tests.

(5) Summarizing the various points of view brought out in definitions of intelligence, it is noted that the aspects which seem to have called forth most comment from psychologists are ability to think in the abstract, particularly to see relations; ability to act in accordance with such insight, which means the suppression of reactions leading away from the end in view, and the furtherance of reactions which would maintain the direction toward that end. In complex situations this power of adjustment or mental adaptation would call for new situation elements (curiosity); to recognize a need to change old patterns (auto-criticism); for capacity to retain the old patterns (learning, memory) which are to be redirected for production of new patterns (creativeness). It calls for power and speed in effecting the desirable reactions so that new errors and difficulties may not be introduced. It is on such mental processes as these that intelligence test constructors built their tests.

(6) Definitions such as given above express the practical views of different workers as to what distinguishes bright people from dull. Thorndike in 1903 stated as his view that there was no such thing as general intelligence, but that rather there were many special and unrelated intelligences and skills. Spearman on the other hand held that two factors underlie intelligence, the one a general ability or common fund of intellectual energy, the other a series of specific skills or abilities such as mathematical or language ability. Thorndike's theory is known as the synthetic theory and Spearman's as the two-factor theory. Spearman held that the factor "g" or general ability explains the intercorrelation of mental traits.

b. Nature.—(1) *Terms.*—Although there is a controversy on the nature of intelligence, some favoring Thorndike's theory and others favoring Spearman's, most are agreed that the terms "intelligence," "general intelligence," "mental ability," etc., are restricted in mean-

ing to intelligence as measured by test. It is recognized that mental ability grows from almost none at birth to a very great deal in adolescence; that it cannot function without a medium in which to develop, and that a certain minimum or common environmental milieu can be presupposed for all citizens within a certain community of one homogeneous culture; that individuals differ in their ability to profit from this medium, and that whereas some individuals may have had a great deal of opportunity and mental stimulation others may have relatively little beyond this fundamental minimum, yet in their response to test questions, the highly advantaged individuals may do no better, indeed, they may score even lower than the disadvantaged ones. It is therefore held by psychologists in comparing people of similar age and relatively similar environments and opportunities that differences in test reaction may be attributed to differences in native ability.

(2) *Physiological basis*.—In general the three main theories advanced as the physiological basis for intelligence are—

(a) The degree of mental ability depends upon the number and arrangement of nerve cells in the cerebral cortex.

(b) That it depends upon the readiness of connections in the synapse.

(c) More recently that this readiness is in turn dependent upon the stimulating effect of the endocrine system.

c. *Growth*.—(1) *Parallelism with stature*.—At birth, children may be regarded as having almost no intelligence, but varying as to potentialities for its development. Development suggests growth, both of structure and function. At the early age levels mental and physical growth seem to be rather closely correlated. This parallelism seems to continue until at about the age 16 to 20 mental growth seems to cease just as growth in stature ceases.

(2) *Rate*.—It is assumed intelligence increases from birth to maturity, and that it then remains more or less constant, only to show decay and weakening during disease and old age. Intelligence is furthermore assumed to increase at a diminishing rate from year to year, during the period of growth. The most rapid increase in intelligence is from birth to 5 years. The next period, from 5 to 10, the growth is not so great but is still steady and easily measurable. During the next 5-year period the increase becomes smaller and smaller, and many psychologists assume that a 14-year-old level on the Binet scale is the level attained by the average adult. Others assume 16-year-old level as the average adult level. At present the tendency is to accept the 14-year-old level in view of the general

results of mental testing in the Army during the war where it was found that the average recruit had a mentality about equal to a mental age of 13.8 on the Stanford revision.

(3) *Regularity*.—Usually the growth of intelligence is constant and regular, but nevertheless there is no reason at present for denying the possibility of irregular development. The assumption of the regularity of the growth rests upon the stability of the intelligence quotient.

d. Limit.—(1) Ordinarily the knowledge to the average doctor or teacher that development of intelligence ceases between the ages of 14 and 16 comes rather as a surprise. They must remember, however, the definite and limited sense in which the term intelligence is used. It is ability to adapt to relatively new situations. It has been found that average 14- to 16-year-old children show as much adaptability as average adults. It does not mean that such children can do or know as much as the average adult. It means that, given a situation as new to the adult as it is to the 14- or 16-year-old, on the average their performances will be about the same. What the individual acquires as he grows older is a greater accumulation of facts, a greater knowledge, a wider experience of doing many different things appropriate to the level of his intelligence. The adult knows many more things than the child because he has had time to acquire such knowledge; he can do many more things because he has had experience in doing them. The depth of his knowledge and the extent of his experience is, however, all through life conditioned by the degree of intellectual development, the growth of which, is believed to cease for all practical purposes about the age 14 to 16.

(2) The absolute level of mental ability grows and develops by noticeable increments from birth up to about the middle of the late teens, after which it remains relatively steady until middle age when a gradual decline sets in with a marked drop in old age for many individuals. The peak or age of greatest ability to learn doubtless varies for different individuals, the duller reaching their fullest limits earlier than the brighter. During childhood ages, growth units are recognized by arbitrary points along the scale of absolute intelligence and are referred to as so many years and months of mental age.

e. Distribution.—The distribution of individuals with reference to general intelligence approaches a normal distribution. In any group tested they will be found to fall into five different grades of intelligence. This may be illustrated by a curve. The middle group of normal includes about 50 percent of the cases. The group is

flanked on each side by two groups called superior and inferior, each containing about 22 percent of the cases, and finally at the extremes there are two small groups designated very superior and very inferior, each containing about 3 percent.

f. Concept of general.—(1) Individuals of the same age differ greatly in every trait that has ever been measured. These differences between members of the human species are quantitative. People are qualitatively the same in the sense that they have in some degree the same instincts, emotions, capacities to learn, to perceive, remember, imagine, reason, and to be satisfied and annoyed.

(2) These individual differences in any given trait are due to a large number of casual factors which operate independently. These factors may be considered under two broad heads, contribution of heredity on native endowment, and the contributions of environment. Each and every ancestor contributes in some degree to the amount of any traits possessed. Environment also provides a large number of influences which may affect traits favorably or unfavorably.

(3) General intelligence is the ability of an individual to adjust himself adequately to new situations. This implies ease and rapidity in making adjustments, ease in breaking old habits and rapidity in forming new ones. It depends fundamentally upon the modifiability of the individual nervous system. The unintelligent has few responses while the intelligent has many. The intelligent responds to a great number of situations; the unintelligent to few. Unintelligent behavior is narrow and restricted and leads to repetition or cessation.

(4) By intelligence is meant a group or composite of native capacities for learning along the lines that require mental operations with verbal, symbolic, and abstract materials. Intelligence tests do not measure all types of capacities to learn, but those that are tested are of great importance. Upon such capacities mainly depends achievement in school and colleges and success in many vocations. Social adaptability, proficiency in managing people, and effectiveness of moral adjustments are also closely associated with this type of intelligence. The correlation of intelligence with ability to acquire various mechanical and motor skills is positive but low.

(5) The possibility of achievement depends mainly upon native capacities, but between competence and capacity, between actual and possible attainments, wide discrepancies are frequently found. Mere capacity does not insure achievement. Achievement is the return on capacity wisely invested in education. Even with age, opportunities to learn, and the proficiency of teaching rendered as nearly equal as possible, gaps between capacity and achievement will still be found.

To account for them would usually demand a complete appraisal of the individual's equipment. It would be necessary to estimate efficiency of sensory mechanisms and organs of response, regulative glands, anatomical and physiological maturity, strength of numerous instinctive tendencies, general and particular emotional propensities, stability of nervous control, nature of habits previously acquired, and various complex traits such as diligence, trustworthiness, ambition, and sociability.

(6) Studies of the correlations of human traits early disclosed the fallacy of the prevalent belief in compensation, the assumption that possession of certain desirable traits implied presence of compensating undesirable traits. General mental ability is positively associated with other desirable traits. On the average, weakness in one trait implies weakness in others, and strength in one, strength in others.

101. Factor in achievement.—*a General.*—"Achievement" is a broad term and any study of the relation of the two variables, intelligence and achievement, requires a high degree of specificity of terms. This difficulty can be met partially by referring to achievement in school, in one's vocation, in earning money, or any other specified type. Obviously success becomes less measurable in moving from the first to the last-named accomplishment. Research workers have been hard put to select a suitable unit to serve as an index of success. They have often resorted to judgments or opinions or ratings by others, but these have been shown to be highly fallible. Some investigators have attempted to use such things as the appearance of the subject's name in *Who's Who* or *American Men of Science* as a criterion of professional success. Often what an individual actually achieves is out of proportion to what he could achieve but for the interference or effect of certain variables such as health, interest and ambition, motivation, economic drive, responsibility toward others, moral support and encouragement by others; and personality thwartings such as timidity, sensitiveness, uncontrollable temper, etc. On the other hand, certain dynamic qualities of aggressiveness and persistence often overcompensate for intellectual weakness. The point is that all possible influencing factors on achievement must be accounted for.

Reports in general agree that intelligence is the most significant single factor in determining successful school work; that the higher the school work required, the greater the elimination of poorer intellects. A certain minimum is required to master work at various educational levels; for example, an I. Q. of 70 is seldom able to do

satisfactory work beyond the sixth grade. In high school the child with an I. Q. between 90 to 100 will have great difficulty in graduating. According to one authority, "the intelligence test stands without a serious rival as a measure to predict college success." Its closest competitor is the New York State Regent's Examination.

The ideal technique by which to study the effect of intelligence and success in life would be to have accurate measures for each; especially to have early measures of intelligence on a large number of children, and later to follow up the attainments of these individuals for correlation data. Terman and Burk have made an excellent beginning in this direction, having followed 1,000 gifted children over a 10-year period. Many have graduated from high school and college. If the study can be continued another 20 years it will be most worth while. As far as they have gone, Terman finds that the prognostic or predictive value of early measurements of intelligence is high.

Turning to the other end of the scale of intelligence and considering achievement of the dullards, the morons, and even the lower grades, an equally close parallelism between intelligence and achievement is seen. At these low levels, there are limits set by mental ability in attaining success in vocational fields. Minimum intelligence requirements for various lines of work have been worked out for something like 96 different occupations.

b. College scholarship and vocational success.—It would be most illuminating to have comparative studies of minimum intelligence scores of men and women in high executive positions, in academic, business, professional, or other fields, and to note what part sheer intelligence has played in the vocational success of these individuals. Unfortunately, such data are lacking because of the psychologists' inability to reach these individuals, and most have left no records of intelligence test scores. Imperfect as the correlation is between intelligence and scholarship, nevertheless college grades afford some clue as to individual differences in mental ability. Several studies have undertaken to compare later success with college standing. Vocational success has often been measured by income earned, but this in itself is often relative to the particular vocation followed. No satisfactory criterion of achievement has been discovered.

An interesting study published in 1928 considers the earnings of 3,806 men all employed by the same company, although coming from 104 different colleges. It was found that those who ranked in the first tenth of their college scholarship represented 17 percent of the highest salary group, while the lowest third in their class earned

only $4\frac{1}{2}$ percent of the highest salaries. After 25 years, the high scholarship men are still going up in salary, while the low scholarship men are dropping. Thirty years of service finds the median salary of men in the first tenth of scholarship to be 155 percent of the median salary of all employed, while the men in the lowest third of scholarship earn only 79 percent of the group median.

The man in the first third in scholarship at college 5 years or more after graduating has not merely one chance in three, but about one in two of standing in the first third in salary, while the man in the lowest third has only about one chance in five of standing in the highest third in salary. There is almost one chance in two that he will stand in the lowest third in salary.

102. Clinical psychology.—*a. Development.*—Although clinical psychology proper dates back at least to the last decade of the nineteenth century, it is undoubtedly true that the Binet scale was the most important factor in its development and expansion. Shortly after the first work with the scale in institutions for the feeble-minded, psychological testing of all kinds spread rapidly to juvenile courts, reformatories, prisons, children's homes, and schools. The psychological clinic did not and does not depend upon the Binet scale, but it is unquestionably true that its appearance acted as a tremendous stimulus to this type of work. Many juvenile courts have found the services of clinical psychology of great value, a few maintaining special clinics and others depending upon the help of outside psychologists.

b. Schools.—Most school systems now recognize the importance of psychological work. School clinics have been established in connection with the education of backward and feeble-minded children. Special attention to the backward child began in the nineteenth century. At first the interest was entirely pedagogical, but it was not long before the help psychology could render was appreciated, and hence came the school psychologist whose duty is to select the backward children for the special classes. The number of these clinics or departments of child study is now great, and the work they are doing varies from minute and thorough psychological testing down to the mere giving of Binet tests to aid in the segregation of the mentally retarded. There is a place in every school system for psychological tests, and unquestionably the future will see a great expansion of their use in the schools. At the present time the center of interest in psychological work in the schools is shifting from mere segregation of the mentally retarded to a wider use of intelligence tests in the classification of pupils in general. Much attention

is being paid to the child of superior intelligence because it is realized that the bright child as well as the dull needs special educational guidance. Undoubtedly the two kinds of measurements (one probing the native ability and the other the knowledge of the child) are complementary, and the future will see a more intimate use of a combination of the two.

103. Nature of present day mental tests.—*a. Basis.*—(1) *Method.*—The intelligence test is a composite of certain tasks selected from the background of experience to which children to be tested by this instrument have been exposed. It is noted how well the child does on such a test and he is given a score or rating. This rating is then compared with ratings made by a large body of children who have had a similar background. The subject's intelligence is said to be better, or worse, or equal to the average; to the top 10 percent; to the bottom 10 percent; or to any other arbitrarily selected unit of distance so long as the scores made by the standardization group of children are used as a basis of comparison. This method presupposes a common background of experience among the children to be compared, such constant factors to include a common language, similar schooling opportunities, approximately similar cultural advantages at home, etc. Hence it follows that a test must be selected wisely to match the background of the child if dependable results are desired. Tests standardized in one cultural medium cannot be transferred and applied to children growing or having grown up in a different culture. More and more it is being recognized that each homogeneous group should develop its own standardizations, and that an individual's rating obtained on any standardized instrument should be compared against ratings of his own group.

(2) *Factors which influence test scores.*—To obtain an impersonal and fair rating, it is presupposed that the subject comes to the test new to the test situation and untutored in the test content. The subject with test experience becomes test wise and has an advantage over the subject who is quite unfamiliar with test procedure. All types and manner of practice effects must be eliminated. Coaching is of great assistance and invalidates results. There are certain factors which tend to influence intelligence ratings adversely and must be considered. These include language handicap and lack of cooperation. The emotional factors seem to play a part and those subjects who become nervous do not do so well. However, all examiners are urged not to administer the test while the child is emotionally disturbed, also to make allowances for possible emotionally interfering factors in the test situation.

*b. Scales.—(1) Stanford revision of Binet-Simon.—(a) Use.—*There have been many revisions of the original scale but the most widely used and best standardized has been Terman's revision published in 1916. The scale runs from age three to superior adult. Terman and Merrill have recently perfected a scale to include these lower and higher levels. When administered by adequately trained personnel, the Stanford-Binet is recognized as the most reliable and valid intelligence test.

*(b) Development.—*Publication by Terman of the Stanford revision of the Binet-Simon scale in 1916 marks a distinct advance of intelligence measurement. Even before publication of the Binet-Simon tests Terman had been interested in the problem of individual differences in intelligence among school children, and shortly after the first publication of the Binet test in 1908, he seems to have become interested in Binet's method. Terman's final revision, extension, and standardization occupied him and his coworkers for 5 years, but the final result certainly justified the labor and time involved. The Stanford revision adds nothing essentially new to the ideas of Binet. What Terman did, however, was to work out more thoroughly and more accurately the method suggested by Binet. The scope of the standardization was broadened and the scale was so adjusted as to fit accurately at each age. Much of what is only implicit in Binet is made explicit by Terman. One other important contribution by Terman is worth noting, namely, the adoption of the Intelligence Quotient as suggested by Stern. The use of the Intelligence Quotient in connection with his scale brought this measure of intelligence into common use.

*(2) Other scales.—*It was natural that the stimulus given to mental testing by use of the Binet-Simon scale should result in the construction of other scales for measuring intelligence. If there are few, it is not because of a scarcity of ideas as to different tests, but rather because of the labor involved in standardization. Some of the more or less standardized scales are the—

(a) Point Scale by J. Yerkes, Bridges, and Hordwick which used the original Binet test but substituted a scoring method for each test and a total score instead of the all or none method and the age grouping as in the Binet tests.

(b) Pintner-Paterson Performance Scale, the first to use tests entirely different from those of Binet. None of the tests in the scale require a knowledge of language by the subject. The scale has been found useful in testing foreign and deaf children, and also as a supplement to the Binet scale.

(c) Army Performance Scale, constructed to supply the Army examiners with a means for measuring mentality of foreigners in the Army when an individual examination in addition to a group test was required. The Army scale has not been standardized on children, but the scores can be turned into an approximate mental age based upon a comparison of performance scale and Stanford and point scale records gathered in the Army.

c. *Use on adults.*—Most of the work which has been accomplished in testing has been done on children. However, it may be stated that there is serious need of an individual scale adapted to fully matured adults. A scale for adults should contain material pertinent to adult experiences and interests. At present the only adult scales in use are group tests. These are of the pencil and paper variety, and are unsuitable for low grade people or for those not accustomed to using a pencil. Adult intelligence tests to be suitable should make provision for the diversity of interests and skills which follow school-leaving age. The test should be comprehensive enough to include a fair sampling of all possible fields of mental skill, or should be specifically evolved and applied to meet the needs of special groups and standardized on those groups.

Much of the present conception of adult intelligence has grown out of the studies of Army psychologists who during the war tested thousands of men in the Army. These men were from all walks of life. The conclusions drawn from this work by certain investigators startled the nation. The basic data of the Army conclusions were drawn largely from scores in the group tests, Alpha and Beta. Later, fuller understanding of the limitations of these test materials has caused many psychologists to discredit most of the Army results.

104. Special ability tests.—a. *Mechanical.*—(1) *Theory.*—A decade or so ago investigators assumed that some people were abstractly minded while others were concretely minded. They sought to devise different measuring tests for those skilled in manipulating ideas and for those skilled in manipulating objects; then comes the need of tools to measure not only intelligence as a general thing but also the special abilities such as skill in assembling the separated parts of mechanical contrivances in artistic execution, in musical appreciation, and the like. The earliest attempts of measuring special abilities were done by Stenquist whose tests of mechanical ability were used by the Army psychologists first to measure general intelligence and later to measure an ability markedly different from that discovered by verbal tests of general intelligence. It might be called general mechanical intelligence and ability. The most recent con-

tribution to the measurement of this special mechanical ability defines it as the ability to succeed in work of a mechanical nature; or mechanical ability is that which enables a person to work with tools and machinery and the materials of the physical world, and in doing so, to perform creditably or to turn out an acceptable product. It may involve inventing, constructing, operating, or repairing simple or elaborate implements and the planning or execution of pieces of work that involve their use. However, the ability covers a range of activities from invention of airplanes and the designing of bridges to the mere insertion of pieces of metal in a machine or the stamping of holes in leather. Their understanding of the term mechanical ability further stresses two aspects; first, skill in actual manipulation of tools and materials, and second, interest and ability to acquire information about such tools and materials and the use to which this information could be and was put.

(2) *Method.*—To illustrate the work which has been done in tests of special ability, the scale produced by the psychologists at the University of Minnesota will be discussed. These workers assumed that mechanical ability was a unitary trait, and set out to develop the most effective battery of tests to measure it. Included in the battery of tests are the Stenquist, Links, Spatial Relations Test; and several tests of motor coordination and ability. The Minnesota battery consists of the Minnesota Paper Form Boards, series A and B; the Minnesota Spatial Relations Boards A, B, C, and D; the Minnesota Assembly Tests, Boxes A, B, C, and D; and the Minnesota Interest Analysis Blank.

These tests show a high degree of reliability with coefficients of correlation running between $+ .84$ and $+ .94$ and low intercorrelations with each other so that no two tests can be considered to tap the same type of ability. Most of the battery can be administered either as a group or as an individual test. About an hour's time is required to do the long form.

The battery scores are computed according to weights assigned by the authors for the component parts of the battery selected.

Tables of norms have been worked out and these norms are expressed in terms of age, grade, percentiles, and sex, and range from grade VII through university groups.

The Minnesota psychologists are convinced that the mechanical ability test battery measures a trait which apparently is relatively unique with respect to all others. The uniqueness of mechanical ability is definitely proven by the evidence. High correlations with outside criteria mean that it easily meets the validity requirements. It also

fulfills the requirement of low correlations with, and therefore independence from, the other traits. Its correlations with intelligence are sufficiently slight to show that though the factor has not been completely eliminated, it is not present to a sufficient degree to make the measures of mechanical ability to any considerable extent measures of intelligence. The correlations of the apparatus test battery with age, height, weight, and motor ability are uniformly low, and in the neighborhood of zero. The authors further claim that whatever these tests measure is mechanical ability, not mechanical capacity, just as whatever is measured by intelligence tests is intellectual ability and not intellectual capacity. Capacity is always an inference from measured ability.

The tests are better measures of what people can do than of what they will do. Actual mechanical output is determined by other factors such as temperament, social pressure, other hobbies, leisure time, and the like.

b. Musical.—There are few tests of musical capacity, but its aspects are more or less measurable such as sensory, motor, and feeling reactions. The test equipment is expensive and it is difficult to reach the more elusive feeling or affective responses; however, for sensory reactions, tests are available. The best known of these is the Seashore measure of musical talent. These tests have been subjected to considerable investigation, and some controversy over validity and reliability has ensued. Seashore is emphatic that his tests of musical sensitivity are not in any sense measures of intelligence. Some of the most gifted musicians are not interested in intellectual pursuits and some of the keenest intellects have no ear for music. Pitch discrimination, for instance, is not a matter of logical judgment but of sensitiveness of the mechanism of the inner ear. It cannot be improved appreciably with practice. It seems that the sense of rhythm and consonance is instinctive and shows wide individual differences. Age, intelligence, and training but slightly affect ability to discriminate time.

105. Group test.—The most recent development in mental testing has been the rise of the group test. Here the subjects are examined in groups in contradistinction to those tests in which the examiner is engaged with only one individual at a time. There is nothing intrinsically new in the group method because it has been employed for a long time in psychological experiments. For the most part however these experiments were not directly concerned with getting an intelligence rating of the individual. The new turn given to group tests at the present time is precisely the attempt to obtain a measure of the individual's mental ability. The group method does not give

all the information gleaned by the expert clinician in his individual examination, but it can give a very reliable intelligence rating.

The entry of this country into the World War and the consequent utilization of intelligence tests in the Army accelerated enormously development of the group test. The possibilities of intelligence surveys of large numbers of individuals opens up new possibilities for the psychologist in the future.

106. Army tests.—The World War presented the problem of selecting, sorting, and assigning millions of men by the quickest procedure possible. The result was the organization of the Army mental tests. Specific purposes were to aid—

a. In the discovery of men whose superior intelligence suggests their considerations for advancement.

b. Selection and assignment to development battalions of men inferior mentally.

c. Forming organizations of uniform mental strength.

d. Forming organizations of superior mental strength.

e. Selecting men for special duties.

f. Formation of training groups within regiments in order that each man receives instruction according to his ability to profit thereby.

g. Recognition of mentally slow as contrasted with the stubborn or disobedient.

h. In the discovery of men whose low grade intelligence renders them either a burden or a menace to the service.

In general, subjects whose mental ages are below 8 years should be considered seriously for discharge. Those whose mental ages range from 8 to 10 should be considered for use in service organizations.

107. Use of intelligence tests.—The beginnings of the intelligence testing movement were closely bound up with the study of mental deficiency and abnormality. It was therefore quite natural that much of the earliest work had to do with the selection of mentally deficient children. For a long time this phase of intelligence testing was predominant. Closely connected with feeble-mindedness is the problem of juvenile delinquency, and it was natural that the juvenile delinquent should very soon attract the attention of the psychologist. In this way the testing spread rapidly to the juvenile delinquent and then to the adult delinquent. Next the dependent child was considered.

From the selection of the feeble-minded in the school it was natural that the interest should broaden and expand into a study of mentality of children in general. The next striking phenomenon was the

appearance of the very bright or superior child. With the appearance of the group test as a method of intelligence examination it became possible to test large numbers of children. The movement soon spread to other groups of individuals, soldiers, prisoners, college students, and the blind and deaf. Intelligence tests in the study of racial differences have been in constant use. The field of industry and commerce is one of the latest fields in which intelligence tests have been adopted. Their value in the selection of employees and in the classification of workers with a view to assignment and promotion has now been fully recognized and they are proving an important adjunct in the solution of the problems confronting the employment manager and the business executive. In the large sphere of vocational selection and guidance mental tests are beginning to find their place.

108. Measurement requirements.—*a. General.*—Any intelligence test to be of practical use must of necessity be—

- (1) Simple.
- (2) Short.
- (3) Heterogeneous.
- (4) Not pedagogical.

b. Criteria.—(1) Tests must be relatively new. This is necessary in order to differentiate between knowledge and intelligence. The tests should avoid specific school information.

(2) Increasing ability at successive age levels. The scale of tests must show that ability increases from age to age among children. Obviously, if a test or scale fails to show this increase, it is of no value as a measure of the child.

(3) Agreement with other judgments of intelligence. There has been found a high positive correlation of results between intelligence tests and the better common methods of judging intelligence.

(4) Reliability. To be reliable the test must rate the child in the same way when applied at various times. These four criteria of any one test within a scale and of the scale as a whole insures a valuable test for the measurement of intelligence.

109. Ways of expressing intelligence ratings.—*a. Mental age.*—This originated with the Binet Scale, but is now used with any set of tests standardized on children of various ages. By a child having a certain mental age is meant that his performance on the test is equal to the average performance of a fair sampling of children of the same chronological age. Thus if average 5-year-olds are able to pass a certain test, a child, regardless of his chronological age, who is able to pass these same tests and unable to pass any higher ones, is said to have a mental age of 5 years.

The validity of any mental age depends upon the thoroughness of the standardization of the scale from which it is computed. It is dangerous to compare the mental ages of children tested by different scales. At the present time the Stanford revision seems to be the best standardized scale and it is the one most widely used.

Mental age is an absolute measure of the child's accomplishment. The relative intelligence of the child can only be estimated by comparing his mental with his chronological age. The easiest comparison is to note how many years above or below his chronological age he may be. However, this is very unsatisfactory because a difference of a certain number of years has a totally different significance at different periods of life. A 4-year-old who is 2 years retarded mentally is much more seriously deficient than a 12-year-old who is also 2 years retarded mentally. This is because the growth of intelligence is much more rapid at the earlier ages and gradually becomes slower and slower. Owing to this difficulty some other method of rating intelligence must be adopted if desired to compare intelligence of children of different chronological ages.

b. Intelligence quotient.—The Intelligence Quotient gives the relative degree of intelligence disregarding chronological age. It is the ratio of the mental and chronological ages. The mental age is divided by the chronological age and the quotient obtained is called the Intelligence Quotient or I. Q. Children testing exactly at age will have I. Q's. of 100, and those above will have I. Q's. greater than 100, and those below will have I. Q's. of less than 100. It allows making direct comparison of children of different chronological ages.

(1) The diagnostic significance of the different I. Q's. is generally expressed as follows:

Intelligence quotients	Mental age, months	Classification
0 to 24-----	35-----	Idiot.
25 to 49-----	36 to 83--	Imbecile.
50 to 74-----	84 to 144--	Moron.
0 to 69-----		Feeble-minded.
70 to 79-----		Borderline.
80 to 89-----		Backward.
90 to 109----		Normal.
110 to 119---		Bright.
120 to 129---		Very bright.
130 to above--		Very superior.

(2) A study of the distribution of the I. Q.'s of a large number of children shows a fairly constant distribution at each age.

Lowest percent	I. Q. (or below)	Highest percent	I. Q. (or above)
1-----	70	1-----	130
2-----	73	2-----	128
3-----	76	3-----	125
5-----	78	5-----	122
10-----	85	10-----	116

c. Percentile.—A type of rating that is becoming more and more popular among mental testers is the percentile rating. In this case the individual's performance is compared with the performances of all the individuals in a particular homogeneous group. A 6-year-old is compared with a group of 6-year-olds; a 10-year-old with a group of 10-year-olds; a college student with a group of college students, or if desired, with a group of miscellaneous adults. The reference always is to a group of which the individual is in some way a member. A 5-year-old's performance is not compared with the average performance of children of different ages. The performance at one age is not expected to be like the average performance at different ages. His performance is compared with the average of his own age, and whether it is equal to the performance of 10 percent, 20 percent, 50 percent, or any percent of the same year old's ascertained. This percentile value is the measure of his ability and it is easy to interpret. It groups him immediately on a scale of 100. It tells how many are above or below him, and his ability can then be described in any way we wish.

The percentile method can be used with a group of tests each of which has been standardized according to percentiles. In this case there will be a percentile rating for each test and the median or average of these percentiles will be the intelligence rating of the child.

The percentile method has found particular favor with group tests. It is unquestionably one of the best methods of expressing an intelligence rating, and its use will become more common in the future. With percentile norms for each age group the necessity of comparing subjects of one chronological age with those of another is avoided. This is a practice which is open to question.

There are certain devices now coming into use for evaluating educational attainment in terms of intelligence. Pintner has employed

the mental index for both his intelligence and educational tests and is therefore able to measure achievement in terms of ability by merely subtracting the indices. The difference is the measure.

110. Standardization.—By standardization is meant the establishment of a certain definite method of giving a test and the establishment of adequate norms for the interpretation of the results. The former may be called standardization of procedure and the latter standardization of results.

a. Standardization of procedure.—It is imperative in giving a test to give it in as nearly as possible the same manner in which the test was originally given, that is, if it is desired to compare results with those of the originator or to measure the intelligence of a child by means of some recognized test. Slight differences in procedure cause vast difference in results.

b. Standardization of results.—By this is meant the establishment of adequate standards or norms by means of which the results of testing any individual case can be interpreted properly. In this work the constant endeavor is to get a fair sampling of cases at each age. What the psychologist ordinarily does is to use the ordinary school child and if he gets a fair mixture of city and rural children, the probability is that he will obtain a fair sampling.

In the higher ages, 13 and above, the difficulty of getting a fair sampling is greatly increased because many children drop out of school before this age, and of those who drop out the inferior or mediocre make up by far the larger percent. All standardizations for these higher ages which are based upon school children entirely lead in all probability to norms that are too high for the population in general. In the Stanford scale average adult intelligence was thought to correspond to the ability of 16-year-old students. The testing of thousands of average adults in the Army leads many to believe that the Stanford tests for age 14 are more nearly adequate measures for the average American adult.

111. Age scales.—For age scales of the Binet type, where each test is either passed or failed, the results will consist of the percentage of children at each age who have passed a given test. The test must fulfill the criteria in paragraph 108*b* and is said to be standard for the age at which about 75 percent pass. The assumption is that the middle 50 percent and also the upper 25 percent will pass the test, making in all 75 percent.

112. Constancy of intelligence quotient.—The constancy of the I. Q. from year to year for each child who continued to live in

a normal environment led to the concept that the amount of intelligence in proportion to age is predetermined by hereditary forces. The constancy of the I. Q. was assumed as one of its fundamental attributes. Then came fresh evidence from data showing changes in the I. Q. with changes in environment. After much work and effort on the stability of the I. Q., conclusions may be summarized as follows: In general, that is, for about half the cases, the I. Q. can be expected to vary up or down from zero to five points, from test to retest for any individual. For a few cases it will vary more or less than 5 points. The extremes may be considered from 0 to 20 points. Deviations are significant when above 10 points which happens in about 20 percent of the cases. Less variation is found in the lower I. Q. than among the normals; changes for this group tend to go in the direction of decrease rather than of an increase. Among superior children the I. Q. remains relatively constant.

Causes responsible for variation in the I. Q., in brief, are that variations of as much as five points from test to test can be looked for from the average individual. The greater fluctuations which occur, though less often, may be explained by a change in actual intelligence ability, or by changes in the conditions inherent in the test material, or in the test situation.

113. Normal distribution curve.—Among adults, who can be considered to have achieved their mental maturity, there is to be found a wide range of individual differences in intelligence. No matter in what units of measurement this mental ability is expressed, there will be found a few people who are extremely dull, a correspondingly few who are extremely bright, and a great mass of individuals of gradually varying ability between these two extremes. When these measurements are plotted and charted, there results what is known as a normal distribution curve. (See par. 100e.)

114. Conclusions.—Prior to 1908 almost no professional techniques existed for detecting any but the dullest among human beings, people at the level of the idiots and imbeciles. Even at this level, fine distinctions of individual differences in intelligences were not possible.

The work of Binet and of others in the next 10 years developed the concept of general intelligence and provided the basis for modern intelligence tests graduated to specific ages, and standardized upon groups composed of individuals with a generally similar socio-economic background. The world was provided a large scale laboratory for the trial use of intelligence tests in the United States.

The immediate results were of practical value to the Army; but later conclusions drawn from the Army data did not take into account the limitations of the tests used, and for a time the whole testing movement in this country was under a popular and scientific cloud.

The decade since the war has seen great progress in the development and standardization of tests adapted for many different uses but more important, psychologists have learned the limitations of their tests, and the careless generalizations of 1920 or even of 1925 are no longer permissible. It is now recognized that all tests are highly charged with environmental content and that they offer a fair measure of individual differences only when used within groups having a similar environmental background. The use of the same tests upon individuals with a different cultural, social, educational, economic, or national background does not give a reliable result, and all interpretations of the many studies which have been made with such tests as a basis must be put forward with great caution.

When, however, this application is limited to a group of individuals with backgrounds similar to that of the group upon which the test was standardized, then we may say that tests have been perfected within the last two decades to a point where they are highly valid and reliable for detecting individual differences in "general intelligence." Equally valid and equally reliable are tests of certain specific abilities, such as music, art, mechanical ability, etc. But the detection and measurement of separate mental "traits" or of separate functions of the mental process must await further research.

Beginnings in the detection of independent mental traits have been made from two points of view, the statistical isolation of independent variables in the composite "general intelligence," and the study of maturation rates of different mental and motor functions or activities. Individual differences in strength of several unique traits and differential development in mental and motor sequences or patterns of behavior should afford significant clues to the student of mental inheritance on the alert for innate mental differences.

Adequate measuring tools, here as elsewhere, are needed to measure growth and change. The psychologist offers adequate tools, but at the same time sounds a caution that these tools and tests must be used only in the light of knowledge of all factors involved in interpretation of obtained measurements. Such caution takes into account conditions which affect the development of intelligence; conditions which affect test scores; conditions which render the selection of certain tests as valid or invalid to the group on whom they are to be applied; a

knowledge of the validity and reliability of the tests based on their own standardization data, and insight into other than qualitative results. obtained by test which should be correlated with test findings.

In spite of their established prognostic value, tests still suffer from certain weaknesses which in time will be corrected through more careful statistical analysis on the part of test constructors. Tests are charged at times with being unfair to the slow reacting individual because speed is often stressed; with being a handicap to the foreign born, because of the verbal content; of giving unfair advantage to the socially wellborn and disadvantage to the lowly born because test materials depend too much on schooling and culture; but, most of all, tests are criticized because they do not discriminate adequately among high level individuals in predicting success in life.

For a long time to come, tests will remain better measures of what people can do than of what they will do. There are many highly intelligent people who lack other qualities essential to success, and there are others destined for later distinction who may not be discovered by intelligence tests today, and there are intellectual functions that are not adequately measured by tests. Granted that personality may make or mar a career, and that a fine intelligence may mean little if blocked emotionally, the psychologist still offers the scores on mental tests as the best single evidence obtainable on the intelligence of human beings.

SECTION XV

WORD ASSOCIATION TEST

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115. General.—All mental activity is based upon the interchange of material of previous experience, sensation and memory traces. This experience may be gained either directly or indirectly. It is gained through actual personal experience or through the experiences handed down from parent to offspring or from generation to generation. Aside from the somewhat questionable capacity to perceive pain or pleasure which is said to be perhaps inherent even in the atom, any psychical activity without association is unthinkable.

All mental and emotive activities are associative. Cogitation is merely the association of previously accepted tenets with each other

or perhaps with newly gained experiences or stimuli. Original thoughts are nothing more than new adaptations. Emotional reactions occur in the same way. If an experience in the past has caused fear, a similar experience always carries a residuum of fear. This is the old association of past and present stimuli.

In all observations upon the psyche the associative processes are encountered again and again. Here everything else is clearly shown to be subordinate to association.

The function of attention has usually received dynamic explanations but this is never very convincing; what really is observed in alterations of attention are alterations in the number and directions of the associations.

Association is the fundamental phenomenon of psychical activity. Perception, thinking, and doing cease as soon as association is impeded. This process may be conceived physiologically quite as well as psychologically, and in both closely unites the psychical with the other neurophysiological functions.

It is self-evident that associations lie at the foundations of sensation (so far as it is conscious), that is the connection of the inflowing nerve stimulus with processes which represent the psyche. If this connection is inhibited, whether reflexly in the lower centers or in the higher regions by distraction of attention or by any kind of anaesthesia, no sensation occurs. The reflex acts prove that the unperceived stimuli travel over the same old associative paths because the reactions do not vary except in degree.

Perception is always understood as association of the new sensation with memory traces of earlier experiences.

Laws of thought are but rules of association. Every association in real thinking is accompanied by an almost endless number of more or less distinct presentations. Thus in the activity of association there is mirrored the whole psychical essence of the past and of the present with all their experiences and desires. It thus becomes an index of all the psychical processes which have only to be deciphered in order to understand the complete man.

From the associations it is claimed that in many cases can be diagnosed dementia praecox, epilepsy, various forms of imbecility, various forms of hysteria, manic-depression, flight of ideas without motor accompaniments, and very searching explorations into the unconscious mechanisms of the psyche made. By associations the mechanisms producing the vagaries and stereotypes of dementia praecox are laid bare. A thorough knowledge of the associations gives promise of a proper understanding of the neurasthenias, psychasthenias, and the hysterias.

116. Reactions to association.—If desired to understand a subject's psyche, his reactions in many different situations must be watched. Since all situations cannot be created, substitutes must be used. Words are linguistic substitutes which are merely condensed actions, situations, things and thoughts. Each word carries with it a distinct and different connotation for each separate individual. Thus though several may react the same to the same stimulus word, reactions are determined by the associated connection between the stimulus and the psyche. Psyches are determined by the whole of past lives, and since no two people have had identically the same past lives with their resultant stimuli and reactions, the stimulus words, although having the same general meaning, have as many variant individual shades of meaning as there are individuals. Association experiments cannot deal with a separated psychic function for any psychic occurrence is never a thing in itself, but is always the resultant of the entire psychological past.

It has been found by experience that the hypothetical normal person reacts in a certain way to various situations, or in this case, to situation substitutes or words. Any criterion of this so-called normal person is not given, but it is known there is a certain specified length of time within which the average individual will give his own reactions to stimuli. Any variations either in time or manner are abnormal both for the particular individual and for the average or the alleged normal person.

The average subject will react in the average way to the average stimulus, but there will always be some to which he will react in an abnormal way, some departure from deadly average. This is because of the personal connotation of the stimulus with his psyche, the intimate associative inter-relation of the reality substitute to accentuated portions either mental or physical of his past life. Thus the stimulus words are actually a part of reality acting upon individuals. A person who shows a disturbance to these stimulus words is in a certain sense and proportion but imperfectly adapted to reality.

Physical disease is an imperfect adaptation to reality because the body does not function properly. This analogy is also true of the psyche. No reaction or faulty reactions to the stimulus words indicates an imperfect adaptation. It indicates a morbidity of some sort in the psyche, something either temporarily or permanently pathological, a psychoneurosis, a functional disturbance of the mind, perhaps a psychosis, or a mere eccentricity. These faulty reactions, these red flags along the psychic road are complex indicators.

A complex is a constellation of ideas of similar affect repressed into the unconscious where it has an independent existence and growth and is constantly striving for expression in consciousness. Because the complex is instinctive, primitive, unreasoning, dynamic, and perhaps sexually tinged, it becomes warped and distorted from its original form by means of the constant addition of new similar libidinous affects and by the force of repression upon it. Since it is alive and dynamic, it is constantly striving for conscious expression. Thus a complex absorbs psychic force in two ways, its dynamic growth and striving for free expression, and the counter force used in keeping it repressed into the unconscious. A certain number of complexes are found in everyone. They help shape and form personalities. Therefore if the association reactions show too many or too strong variations from the norm, the subject shows an undue number of complexes. An undue number of complexes means an excessive amount of psychic force diverted, some claim perverted from normal, useful, average, sociological aims. The subject then shows too great a diversity from the herd average and he is known as abnormal. If the complexes require too great an expenditure of psychic urge, there is too little left to cope with the ordinary stresses and strains of reality. The subject then is unable to cope with reality. He cannot make the required sociological adjustments, and becomes either eccentric, psychoneurotic, or psychotic.

In consideration of the various faulty reactions will first be observed the lengthened reaction time and its complement, no reaction word at all. The stimulus word impinges upon a tender spot in the psyche and a pain or disturbance ensues. The reaction is impeded, the adaptation to the stimulus word is disturbed, and a departure from the normal average is observed. It often happens that the subject actually does not know what to answer to the stimulus word. He waives any reaction; for the moment he totally fails to obey the original instructions, shows himself incapable to adapt himself to the experimenter. If this phenomenon occurs frequently in an experiment it signifies a high degree of disturbance in adjustment. It is immaterial what reason the test person gives for the refusal. Some report that too many ideas suddenly occur to them, others that not enough ideas come to their minds. In severe cases the blocking may be so great that no reaction at all is given. Both of these methods of reactions are defense mechanisms on the part of the psyche. When too many ideas come to consciousness the psyche is throwing out a smoke screen in order to present the least painful and most favorable. When no ideas are presented to consciousness

the psyche is dodging pain by hiding and the tender complex is repressed into the darkness of the unconscious. To some stimulus words some subjects give more than one reaction. They are not satisfied with one word but they react with many words. Here again the instructions are not fulfilled, a failure of adaptation. The test person is unable to suppress the ideas which are secondarily aroused by the stimulus and he adds something explanatory or supplementary. One word is not enough, so more must be added for the sake of completeness as though the first word were incorrect or in some way imperfect. This seems to be a rather universal manifestation in the psychic life of neurotics. This characteristic translated into the psychology of every day life signifies that the test person has a tendency constantly to give to others more feeling than is required and expected. In this elementary observation is seen one of the main qualities of hysterics which is the tendency to allow being carried away by everything, attaching enthusiastically to passing fads and fancies and therefore promising too much and doing too little. These failures to follow instructions may be many and varied. But the reactions show that the stimuli apparently act with excessive strength, that is, they are taken as if they were direct personal questions. In other words, the reactor unconsciously sees in the stimulus words something antagonistic against which he tries to defend himself. This shows another common peculiarity of hysterics; they take everything personally, are never able to remain objective, and are carried away by momentary objectives. These type reactions are characteristic of an enhanced object libido.

These complementary or added reactions are basically caused by an overwhelming and imperfectly sublimated inferiority complex. The autistic base because of its loosely adherent fragmentation is in a continual state of flux, is constantly presenting to the light of reality a kaleidoscopic appearance.

Another sign of impeded adaptation to reality is the often occurring repetition of the stimulus words. The reactors repeat the stimulus words as if they had not heard nor understood distinctly. They repeat it just as a difficult question is repeated in order better to grasp it before answering. The questions are repeated because the stimulus words act on hysterical individuals almost like difficult and personal questions. This is another form of a defense mechanism. The psyche is touched in a particularly tender complex and dodges and stalls for time by a repetition of the stimulus word. This allows a secondarily related complex to come to the surface of consciousness or for some superficial irrelevant reaction to be given.

In many experiments it is noted that the same reaction constantly reappears in response to the most varied stimulus words. These words seem to possess a special reproduction tendency and have special relationship for the test person. These signs are not found arbitrarily spread throughout the whole experiment, but only in very definite locations, that is, in those stimulus words which strike against special emotionally accentuated complexes. This fact is the foundation of the so-called diagnosis of facts; that is, the method employed to discover by means of an association experiment the culprit among a number of persons suspected of a crime. That this is not only possible but feasible has been proven time and time again.

It has been thought by some that the association test enables one to distinguish certain intellectual types. This is not the case. The test does not give us any particular insight into the purely intellectual, but rather only into the emotional processes. Certain types of reaction can be erected; they are not, however, based on intellectual peculiarities, but depend entirely on the proportionate emotional state. Educated test persons usually show superficial and linguistically deep-rooted associated associations, whereas the uneducated form more valuable associations often of ingenious significance. This behavior perhaps might seem paradoxical from an intellectual viewpoint. The meaningful associations of the uneducated are not really the result of intellectual activity, but are merely the results of a special emotional state. The whole thing is more important to the uneducated, his emotion is greater, he is more primitive, and for that reason he pays more attention than does the educated person. That is why his reactions are more significant. The uneducated reactor has only his own actual personal experiences to draw from, and, because of this paucity of material, his reactions are those distinctive of his psyche. The educated reactor has a great store of proxy experiences that have been gained by education. Therefore, a more or less casual investigation would be scattered over a greater psychic area but would not extend so deeply as that of the uneducated reactor.

117. Types of reaction.—The three principal individual types of reaction are an objective type with undisturbed reaction, the so-called complex type with many disturbances occasioned by the constellations of complexes, and the so-called definition type.

a. Definition.—(1) In the definition type the reactor gives definitions or explanations of the stimulus word, such as—

Apple—a tree, fruit, red.

Table—piece of furniture, round.

Father—chief of the family.

This type of reaction is found chiefly in stupid persons and is therefore quite usual in imbecility. It is also found in those who are not really stupid and who do not wish to be considered stupid. The reactor gets the idea that the experiment is an intelligence test and reacts with definitions because most of his attention is directed to the significance of the stimulus words. The associations therefore look like those of an idiot. Not all idiots however react with definitions; probably only those so react who would like to appear smarter than they really are. The widespread complex might be designated as an intelligence complex.

(2) A normal test person may react in a most overdrawn and affected manner such as—

Anxiety—heart anguish.

To kiss—love's unfolding.

This type gives a constrained and unnatural impression. The reactor wishes to be more than he really is. Hence, persons with an intelligence complex are usually not natural and are constrained; they are always somewhat unnatural and flowery; they show a predilection for complicated foreign words, high sounding quotations and other intellectual bric-a-brac. In this way they try to impress their fellow beings with their apparent education and intelligence, and thus compensate for their painful feeling of stupidity. This is just another variation of the many-sided defense mechanism. The definition type is quite closely related to the predicate type or more precisely, to the predicate type expressing personal judgment, for example, flower—pretty; money—convenient; knife—dangerous.

b. Predicate.—(1) In the definition type the intellectual significance of the stimulus word is rendered prominent, while in the predicate type the emotional significance stands out. There are predicate types where there appear reactions as—

Piano—horrible.

To sing—heavenly.

Mother—ardently loved.

In the definition type an absolute intellectual make-up is manifested or is simulated, but in the predicate type it is emotional. Just as the definition type gives a pseudo-intellectual reaction to cover a real lack of intelligence, so the predicate gives an excessive emotional overexpression as a cover reaction to overcompensate for or to conceal an emotional deficiency. These conclusions are very strikingly illustrated by the findings and are proved by intensive psychoanalysis. Upon investigation, it has been found that young individuals seldom

possess a predicate type of reaction, but, on the other hand, the predicate type increases with advancing age. In women this marked increase begins about the fortieth year and in men about the sixtieth. This is the precise time when, owing to the deficiency of sexuality, there actually occurs a very considerable emotional loss.

(2) If the reactor evinces a marked predicate type it may always be inferred that a distinct internal emotional deficiency is thereby compensated. Hence the old saying that it is hard to grow old gracefully. However, one cannot reason conversely that an inner emotional deficiency must produce a predicate type no more than that idiocy directly produces a definition type. As was said above, the predicate type also betrays itself through the external behavior as, for example, through particular affectations and enthusiastic exclamations over everything when all things are overaccentuated. There is a highly embellished behavior, and a stilted and constrained sounding language. The internal glandular secretion enthusiasts claim that these variations of a bankrupt emotion are caused by deficient secretions, and that they can be restored to normalcy by replacement of proper secretions or glands.

(3) Both the definition and the predicate types of reaction are a positive effort on the part of the subject to exert a definite influence on the experimenter. In other words they are a false face, a disguise by means of which the reactor endeavors to change and enhance his external appearance. The complex type of reaction on the contrary shows no particular tendency other than the concealment of the complexes. The complex type of reaction is the rouge under which one conceals the imperfections of the natural complexion. The definition and predicate types are positive, while the complex type is more or less passive.

c. Reproduction.—The reproduction following the association experiment is quite valuable. The same stimulus words are repeated and the test person is asked to remember and give their same reactions. In many instances this cannot be done. These stimuli have touched an emotionally accentuated complex, or have affected stimulus words which immediately follow such critical words. This phenomenon might be said to be paradoxical. It is well known that emotionally accentuated things are better retained in memory than are the indifferent; the greater the emotional affect of an incident the more indelibly is it stamped on the memory. Although this is true, it does not hold true for the linguistic expression of an emotionally accentuated content. On the contrary one very easily forgets what he has said while under heightened emotional tension and is

quite apt to contradict himself in later accounts of the incident. This is well illustrated in everyday life by the fact that a dozen different witnesses will give a dozen different accounts of the words used in a quarrel if asked a few days later. The reproduction, therefore, accentuates the complex stimuli and renders them more prominent. Normal persons usually give a limited number of false reproductions, but very seldom more than 10 to 20 percent, while in abnormal people, especially hysterics, there are often from 20 to 40 percent of false reproductions. The reproduction gives added value to the association as an emotive test.

118. Performance.—In the performance of the word association test the following conditions and reactions are observed:

a. Subject.—The subject is asked to remain absolutely quiet and as nearly relaxed as possible. He is then to tell the first thing that comes to his mind when the stimulus words are read aloud to him. He is cautioned against exercising judgment on his own answers, and to tell at once whatever appears in his field of mental vision.

b. Stimulus words.—The stimulus words are those selected by the Zurich school of analysts after several years of painstaking work and now used by practically all analysts throughout the world. The technical association words are 24 picked from an original list of 100 arbitrarily selected as being most likely to arouse past aviaional events.

c. Reactions.—(1) *Time.*—(a) An absolutely normal person will give a reaction to the stimulus in an average of $2\frac{2}{5}$ seconds, or less time. Where the average reaction time to the stimulus words is greater than $2\frac{2}{5}$ seconds, the subject shows definite retardation. In the normal subject the stimulus words that are complex indicators show a lengthened reaction time because of the past repression of these complexes, but the associations to the other stimulus words which are under no repression come quickly and without effort. In no one subject will all of the stimulus words be complex indicators, therefore when the average reaction time is greater than $2\frac{2}{5}$ seconds the subject shows definite retardation and is unfitted for flying. It can readily be seen how a man with a slow and faulty reaction to the constant stresses of flying which necessitates quick and accurate decisions, will eventually come to a “wash-out” of both himself and ship.

(b) A decrease in the average reaction time in the latter half of the test would indicate a display of will power leading to a better concentration. The reverse would indicate a mind easily fatigued and distracted.

(c) Long reaction time indicates a complex. In other words, some repressed idea has been awakened by the stimulus word and the subject's mind has made an effort to give expression to it. Either the idea has come to consciousness slowly rising through the weight of past repressions, or a similar idea less objectionable has been substituted for it, and thus the answer is delayed. The disturbance caused by touching a complex may spread to the next two or three reactions. The stimuli affected should be tried several times in order to determine whether their reaction time was unduly lengthened through proximity to a stimulus revealing a complex, or whether they too are connected with some unconscious repressive activity.

(2) *Subject*.—When the subject repeats the stimulus word, he betrays the fact that the word has a very personal import for him. If he repeats it several times, the connotation is likely to be unpleasant or humiliating. He gives himself time to find an answer.

If the word is misunderstood or if the subject asks the analyst, "what do you mean," the word has some very painful association. This question when asked on hearing words like "to fall," "sin," "crash," "ground," "fear," have a very obvious meaning. The subject is unconsciously hoping that he has not heard the right word.

Flushing or shrugging or smiling suddenly after words like "kiss," "sin," "fall," reveals usually a personal experience.

If the subject's eyes are cautiously opened and then quickly shut the analyst knows he has touched a sore spot. The subject wants to know what impression he has made.

A subject who gives several words instead of one single word in answer to the stimulus word is giving more than is asked, and is thereby betraying a feeling of inferiority and incompleteness by his excessive desire to please and his overcompensation.

The same answer to several stimulus words indicates an obsession in the patient. Jung cites a patient of his who answered "short" to several words on the stimulus list. All his life he had been disturbed over his small stature.

The subject who gives definitions instead of one reaction word belongs to the inferior type of intelligence that feels compelled to state the obvious.

Literary answers such as "kiss," a token of love, reveals an affectation and an effort to appear refined and cultured. It also shows excessive egotism and vanity. This type should be studied under this defensive cover of affection for inferiority complex.

The shallow, emotional type usually gives gushing answers such as "flowers, very lovely things".

The egotist will express his own feelings in regard to the stimulus words as "bread, I like toast," "green, I don't like that color."

Subjects with a contrary turn of mind or a tendency to a splitting of the personality will answer with the opposite whenever possible. Study them carefully for possible praecox symptoms.

The normal subject will give the same answer several times in succession to the same stimulus words. Variation is an indication of a repressed complex striving for expression.

If the reproduction is faulty, the analyst knows that there is a complex connected with the stimulus word. There is displayed an unconscious withholding of a direct answer and the offering of substitutes for what should be the actual reaction.

When a number of complexes have been found, a secondary list of stimulus words is established taking the indicated complex words as a basis, and a new reaction test made which will enable the analyst to determine the exact limits of each complex. For instance, a money complex might be uncovered by establishing a list that would contain all the words connected with money: earning, saving, giving, spending, money, rich, gambling, etc.

Secondary complexes can also be discovered in this way. The subject is then asked to elaborate upon the complex words. The analyst asks the subject to tell him not simply the first thing that comes to his mind but everything, regardless of sequence or relevancy. A long pause in the narrative always points to some complex. The gap indicates according to its size a large or small amount of painful repressed material.

When the subject stops and says, "that's all," the analyst's task really begins. By patient digging right there the analyst will most likely uncover a corpse of reminiscence buried under a mass of repression. As Freud says, "neurotics suffer from reminiscences." The expressions "that's all" or "I can't think of anything else" are unconscious attempts at blocking the search when it is likely to run dangerously close to something hidden.

All of the reaction words and their faulty reproduction stand in close connection to another and are related to the obsessive idea and the emotional complexes responsible for the patient's mental condition.

When the subject uses the expression "as if" the analysts know it should be regarded as "did".

119. List of stimulus words.

Test word	Association	Time	Test word	Association	Time
Head			Zoom		
Green			Pity		
Water			Yellow		
Loop			Dizzy		
Sing			Street		
Dead			Bury		
Long			Salt		
Tailspin			Faint		
Ship			Dream		
Make			New		
Woman			Habit		
Liquor			Pray		
Friendly			Pursuit		
Landing			Money		
Ask			Silly		
Cold			Book		
Crash			Plum		
Stalk			Injury		
Dance			Marry		
Bread			Home		
Rich			Hasty		
Tree			Glass		
Contact			Fight		
Jump			Wool		
Village			Big		
Side-slip			Cloud		
Pond			Insult		
Sick			Give		
Pride			Bird		
Wing			Walk		
Bring			Paper		
Ink			Parachute		
Angry			Wicked		
Propeller			Frog		
Needle			Try		
Swim			Formation		
Go			Hunger		
Rudder			White		
Blue			Child		
Lamp			Miss		
Carry			Speak		
Stick			Pencil		
Hooch			Sad		
Motor			Wait		
Despise			Cow		
Finger			Name		
Jolly			Goggle		

Test word	Association	Time	Test word	Association	Time
Luck			Family		
Say			Pleased		
Table			Wound		
Naughty			C. O.		
Brother			Chair		
Afraid			Worry		
Love			Kiss		
Nose-dive			Bride		
Doctor			Clean		
Frosty			Bag		
Flower			Choice		
Beat			Bed		
Grounded			Father		
Box			Evil		
Old			Mess		

SECTION XVI

REACTION TIME

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120. General.—*a. Experiment.*—The general problem of all reaction time experiments is the same, that is, to produce certain definite impressions upon the organs of sense, to secure a definite result in the form of motion of some part of the body as a sign that the impressions have been received, and to measure with extreme accuracy the interval between peripheral stimulation and resulting motion.

Electrical current is commonly used to mark both the moment when the external sense stimulus acts on the organ and when resulting motion occurs. The stimulus may be visual, auditory, or tactual, a flash of light, appearance of letters, sound of a bell, etc. The response may be made by the finger pressing a key, hand or foot making or breaking a circuit, or vocal organs calling into a tube. These experiments need to be repeated many times upon the same individual so as to eliminate the variable factors of bodily condition, attention, distraction, etc., and they need also to be repeated with many individuals in order to calculate the so-called personal equation.

b. Reliability requirements.—Reaction time to be reliable indicates nothing unless—

(1) Subject has had ample practice to permit the reaction to be mechanized.

(2) Sufficiently large number of reactions are taken under each of the compared reactions. Two hundred reactions after the subject is trained is said to be a fair number.

(3) All the reactions included in the same average were made in the same way. Tests made with the left hand and with the right cannot be used together.

If there is time enough and under proper conditions, reaction time is a reliable method of measurement, otherwise results are very misleading.

c. Definition.—The interval between the instant when the external stimulus begins to act upon the organ of sense and the resulting movement of some part of the body is called reaction time. It differs from reflex time in that it refers to reactions which are not instinctively related to the stimulus used.

121. Simple.—Reaction time is simple when all the elements which tend to complicate the process involved in the reaction have been eliminated. The result is best obtained by getting a simple natural motion in response to the stimulus. Even the simplest reaction time is a very complex affair, and it is necessary to determine the average reaction time of each person experimented upon.

122. Elements.—There are generally conceded to be seven elements in reaction time:

a. An action of the stimulus on the end organ of sense preparatory to excitation of the sensory nerve.

b. Centripetal conduction in this nerve.

c. Centripetal conduction in the spinal cord of power parts of the brain.

d. Transformation of the sensory into motor impulse.

e. Centrifugal conduction of the impulse in the spinal cord.

f. Centrifugal conduction in the motor nerve.

g. Setting free of the muscular movement.

The fourth factor (transformation of the sensory into the motor impulse) is most interesting to psychologists. The other six elements have been quite definitely determined so it is theoretically possible to subtract their sum from the entire reaction time and the amount left is the interval occupied by the central nervous processes.

In any reaction time work, account has to be taken of the inertia of the nervous system, the time which it requires to start responding

to a stimulus to reach the maximum of activity in a given direction and then to subside into a negative condition. The amount of inertia varies with the different end organs of sense, the nerve endings of touch responding more quickly to stimuli than any others.

123. Variations.—Reaction time varies with the sense organ which is stimulated. Under the most favorable circumstances reaction time can scarcely be reduced to $\frac{1}{10}$ of a second while it rarely rises above $\frac{2}{10}$ of a second. Reaction to painful stimuli is very slow. If a pain spot is stimulated directly there are two sensations of pain with an appreciable interval between. The reaction to taste is slow and varies with the part of the tongue to which the stimulus is applied and with the particular taste aroused. Of reactions to heat and cold, the former are longer. Reaction to smell is very slow indeed, probably due to the relative inaccessibility of the sense organ. Reaction times to cutaneous stimuli vary with the part of the skin excited. The reaction time for sight is longer than that of hearing or touch. There are various explanations of the difference in reaction times but the one most generally entertained is that the difference of inertia or latent time of the different sense organs causes the difference in reaction time.

124. Types.—The three types of reactions are complex, discriminative, and associative.

a. Complex.—Complex reactions are those in which several mental factors intervene between the stimulus and the motor response. Such reactions will involve responses with the right or left hand or foot, etc. The reaction to be correct must be held back until the stimulus is recognized and discriminated from other stimuli. With practice, each movement becomes so associated with its proper stimulus as to follow it immediately as in reading when no consciousness of a volitional character intervenes between the stimulus and its response.

b. Discriminative.—The time in discriminative reactions varies according to conditions. Speed increases with practice in associating a given movement with a given stimulus, but the reaction never becomes as prompt as the simple reaction because there are more factors involved. In general, diminishing the difference between two stimuli increases the discriminative reaction time. The study of discriminative reactions is capable of giving information regarding the comparative ease or difficulty of different processes of discrimination, provided only that all the conditions of the experiment remain the same so that the only factor influencing the reaction time is the difference between stimuli.

c. Associative.—A certain amount of association is already involved in the discriminative reaction, since definite movements are associated with definite stimuli. In the typical association reaction experiments the subject knows the general character of the stimulus and the necessary response. For instance, he may be shown a number and told to respond with the next larger number, or to reply to a word with the first word suggested by it. Long standing of the associations favor quick response, but the immediate preparation for the stimulus and the movement cannot be so complete as in the discriminative reaction and it consequently takes a longer time. At its quickest, it occupies half a second or a little less.

d. Factors.—There are two factors influencing simple and discriminative reactions, perfection of the preliminary preparation, and degree of perception necessary to initiate movement. To these a third factor is added for associative reactions, the degree of closeness of the previously formed associations between the stimulus and the response.

Naturally, familiar associations operate more quickly than unfamiliar associations. What is more worthy of note is that the association time reveals differences in associations which are not discoverable by any other means.

The aim of all reaction times is to isolate a single factor as far as possible and so determine its speed and the process by which it is accomplished. But this can never be accomplished perfectly. There is bound to be overlapping of successive reactions and the effect of habit and practice cannot be entirely eliminated.

SECTION XVII

FOREIGN RESEARCH

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125. Italian.—Italy was the first during the World War to take up very extensively research in aptitude for flying. In the preliminary work a number of tests were tried out upon pilots known to be successful aviators, upon another group rated mediocre, and upon a third group rated poor. The conclusions reached were: "A good airplane pilot is one who to a sufficient speed of perception and to a notable de-

gree of extension and distribution of attention adds constancy, precision, coordinating ability of the psychomotor activity and who possesses a sufficient inhibitory power of emotive reactions not to be disturbed in the above functions on account of the emotional stimulus.'

There were laboratories at Naples, Turin, and Rome, and at each laboratory candidates were given the routine examination and also tested by the various special tests devised by the scientists in charge.

Simple reaction times to visual and auditory stimuli were used in all the laboratories. The reactions were recorded with a Hipp chronoscope. The stimulus for visual reactions was a green diaphragm lighted by a two-candlepower lamp and for auditory reactions a lever falling from a fixed height and striking a key. The values ranged between 0.170- and 0.200-second for visual stimuli and from 0.130 to 0.150 for auditory, values above these being considered slow and the individual rejected. Of 13,936 candidates, 247 or 1.7 percent were disqualified on this test.

Choice reactions were made with the right or left hand in any of four directions. Combined reactions were made with hand and foot.

Five 16-candlepower lamps were arranged in a frame, two upper, two lower, and one in the center, and underneath was a small check lamp. There were two keys on the table for the hands and two under the table for the feet. The subject was required to react to any light or combination of lights and might be called upon to react to any two lamps simultaneously. The check light showed whether the reaction was correct.

The Italians also used a much more complicated test with an apparatus known as a "carlinga." The carlinga reproduced in some respects the cockpit of an airplane and could be moved in various directions. The candidate, blindfolded, was required to indicate the vertical after he had been tilted from the vertical, and again without being blindfolded was required to respond quickly by means of his control column to some sudden tilt of the machine. His potential aptitude for flying was estimated in part by the character of his responses under these conditions.

The simple reaction time tests were also used on men who had been returned from the front because of nervous exhaustion. Two fundamental types of subjects appeared from these tests, the type who slow up because of exhaustion and weakness, and the opposite type who exhibit excitability and instability. The first type is characterized by a longer reaction time and the second presents a shorter reaction time but greater variability, thus showing uncertainty and instability.

Emotional reactions were studied in all the laboratories. The technique was as follows: rubber tubes were adjusted, one to a double pad over the common carotids, another over the chest, another over the right hand and another to a glass tube in which the left forearm is inserted. The tube was then filled with water and the kymograph drum started revolving. The needles recorded the pulse of the carotids, the respiration, whether there was any tremor of the right hand and the level of the vasomotor tone in the left forearm. A sudden terrific noise was then made behind the subject, causing all the needles to take a jump. If the needles quickly returned to their normal level, it indicated that the subject had an involuntary start when the stimulus occurred but that he was not fundamentally disturbed because his heart beat, respiration, steadiness of hand and vasomotor tension showed immediate recovery. In other cases where the subject did not recover his composure, the records show a rapid pulse, hastened respiration, tremulous right hand, and a drop in the vasomotor tension line, all evidence of shock. This type of reaction was unsatisfactory and the subject disqualified. Of 13,936 candidates examined, 232 were disqualified as excessively emotional, about 1.3 percent. The emotional stimulus was also given between sets of simple reaction times. In every case the reaction time is longer after the stimulus, varying from 3.4 to 30 percent.

From the results of all their observations and experiments the investigators concluded the following as to types of aviators and their fitness to fly. Having followed pilots in their flying careers for some time, making note of their fluctuations of performance, attention and inattention to work, etc., they were convinced that the fitness for flight of navigating personnel is not stable but fluctuating, dependent upon various external and internal conditions, and that the duration of fitness of personnel is quite limited without it being possible to fix a period of time equal for all.

A psycho-physical profile was compiled for each pilot, that is, a diagram which enabled them to establish rapidly the characteristics of every pilot. In the first investigations they maintained that in order to be a good pilot it was necessary to have a high resistance to emotive stimuli; but they later discovered that many of the best pilots of pursuit planes not only did not show great resistance to emotive stimuli, but on the contrary presented much emotivity. They also found that these pilots have an unusually keen perception of the position of their bodies, quite low visual and choice reaction times which reveals a prompt and agile psycho-motor activity. The Caproni pilots, on the other hand, presented considerable resistance

to emotive stimuli and were muscular types or mixed, whereas the pursuit pilots presented a simple reaction clearly sensorial.

They conclude therefore that to the pursuit planes should be assigned those individuals who present a prompt and stable psychomotor activity and a good motor coordination, and to the bombing planes should be assigned in preference those individuals who present a good emotive resistance, high powers of attention, resistance to automatism, etc.

126. French.—*a. Purpose.*—By the methods of examination described below the investigators proposed to discover—

(1) Aptitude for flying when recruits.

(2) Appreciation of the element of fatigue so often described by pilots, fatigue following overtaxation in squadron work, prolonged flights at high altitudes, trauma, crashes, and various other causes.

(3) Ordering rest for these patients or advice as to their transfer to a special and less trying post before it was too late, that is, before the wearied pilot became definitely unfit for aviation, and supervision of pilots upon their return to progressive training.

All these things they believed could be discovered by the careful use of reaction time tests. These they modeled after the Italian tests and adapted to their own uses.

b. Procedure.—A table was divided in two by a vertical screen which hid the movements of the observer and which bore the various instruments to produce visual, auditory, and tactile stimuli. These instruments were an incandescent lamp, an electric bell, and two isolated metal plates to produce impressions of touch. The reactions were marked on a chronoscope which registered .02 of a second.

While conducting the test it was necessary to be sure that there were no outside stimuli, auditory or otherwise, to superimpose themselves on the stimuli to be tested. The stimuli were produced at intervals sufficiently long and irregular to overcome any possibility of automatism or rhythmic response on the part of the subject.

The averages of the reaction times to visual, auditory, and tactile stimuli were in seconds—

Visual, 0.190.

Auditory, 0.140.

Tactile, 0.140.

A normal average was essential but there was another factor nearly as important, that is, regularity or stability of reaction time. It was stated that if results showed marked instability, it should immediately be deduced that the pilot was in poor condition, which fact

they claimed was always substantiated by statements from the medical officer.

Reaction time becomes slower with age though of course the slowing down process varied in different persons. The psychologists were of the opinion that the French age limit for entrance to the air service, 30 years, was too high and might better be placed at 25 for the reactions would then be quicker and more stable.

The reaction time period was largely modified by any kind of pathological state, particularly by beginning infectious diseases. In determination of fatigue, the French consider the tests invaluable. The reactions of a fatigued pilot were always more or less slowed down and above all showed very marked irregularity. They stated: "If, in an airman who was previously an irreproachable pilot and who suddenly states that he is fatigued, marked changes in reactions are found, do not hesitate to give him the necessary time for rest. If, on the contrary, you meet a pilot who states that he is fatigued but whose reactions are not modified, pay no attention to his words."

The French also used reaction times in the examination of men suffering from the effects of crashes to determine whether they could safely be returned to flying duty and when. It is a question whether the French have not placed too great a faith in their reaction time tests. They have some excellent examples of individual reactions to bear out their ideas, but to guarantee the validity of such sweeping statements as they have made they should have an average of at least two hundred individuals, which their reports do not show.

During the World War they used an emotional stability test based upon the Italian test, but this was later discarded in favor of reaction times.

127. British.—*a. General.*—The British paid little attention to reaction times and the more elaborate studies of resistance to emotional stimuli. The latter was included in an incidental manner in a motor coordination test. The principal application of psychological tests by the British was in the determination of the effects of altitude flying and in the studies of staleness in pilots rather than in the routine examination of candidates. Most of the experiments were concerned with physiological data, pulse, blood pressure, vital capacity, etc., but some showed a psychological aspect. The most distinctly psychological experiments included the McDougall dotting test, studies of tremor, and a study of temperament and service flying. The effects of altitude were studied by carrying the subject to different altitudes in a plane and taking reaction times both before and

after flight. The reaction times taken afterward were always distinctly slower.

b. McDougall test.—The McDougall test was used before and after flights with oxygen. The machine sends out a tape like a ticker tape which has small circles on it. The subject with a pencil is supposed to touch the center of the circle as it comes from the machine. The rate of movement of the tape can be regulated by the experimenter. It is started at a normal rate and gradually increased until the subject's performance breaks down. The results showed improvement with the administration of oxygen and deterioration without it. The administration of oxygen to stale or mentally fatigued subjects increased their performance 20 to 30 percent.

c. Motor.—The British laid great stress on simple motor coordination tests such as walking a line heel to toe and turning on one foot, standing on one foot for 15 seconds with eyes open or closed, balancing a rod on a flat board with eyes open or closed, and on indications of tremor. Failure to pass the balancing tests was due to want of control and not to defective muscle sense, also to clumsiness in action. The rod balancing test is recommended as a useful method of testing states of exhaustion, flying stress, insomnia, and other neuropathic and psychopathic conditions in early stages of development.

d. Tremors.—The presence and degree of tremor revealed by requiring the subject to stretch out his arms in front of him, fingers semi-flexed and eyes closed, at the same time protruding his tongue, was carefully noted. A high correlation is found in the group which showed tremor with want of aptitude to fly. Tremor is absent or slight in the good pilot. Of 54 candidates who were accepted in spite of marked tremor, 14 did not qualify, a ratio of 2.8 to 1. Among 2,000 candidates who showed no abnormal signs, 7.6 percent only were ultimately rejected. It is the conclusion of Head that "tremor is not so much an indication of a neuropathic temperament as of a definite disturbance of function. A tremulous tongue may be indicative of chronic indigestion or alcoholic excess, tremor of the hands was always found to be associated with some obvious cause as alcoholic excess, excessive smoking, especially the perpetual misuse of cigarettes, or as a sequel of malarial infection. It was found most commonly however as a sign of stress at the front, exhaustion, and states of anxiety, and was universally present in those officers who were admitted to hospitals as a result of some functional disturbance such as shell shock. The line drawing and noise test was regarded as a valuable test and its use recommended in the examination of pilots and candidates.

e. Line drawing and noise test.—The candidate is asked to draw a line lightly and deliberately across the greater length of a sheet of foolscap paper, parallel to the border with a lead pencil without letting the hand or arm touch the paper. The presence and degree of tremor can be seen, especially if a magnifying glass is used. He is then asked to draw another line the same way; while he is doing this, an unexpected loud noise is made close to his ear with a Dalby clacker. A perfectly sound man will often continue the line without interruption or a slight irregularity will occur in the line before it is again firmly continued. The effect on a nervous man is either to produce a sudden dash and complete stop or the line is continued in an increasingly irregular and shaky manner. He is then asked to draw a third line after being warned that the noise will be made at some point during the experiment. If the nervousness is under control the line will not be interrupted; if not the same hurried dash and complete stop is seen, or the rest of the line is drawn with increased tremor and irregularity.

f. Reid test.—The British have recently adopted a test developed by Flight Lieutenant George H. Reid and Group Captain Martin W. Flack of the R. A. F. As yet it is believed the use of the test is still in an experimental stage, but the Air Ministry is definitely committed to the use of the apparatus.

(1) *Apparatus.*—The apparatus is in the form of an airplane fuselage consisting of a cockpit, stick control, rudder bar, and indicator board. Mounted on the indicator board are three rows of lights, curved, vertical, and horizontal. The curved row is controlled by lateral movements of the stick, the vertical row by fore and aft movements of the stick, and the horizontal row by movements of the rudder bar. There are nine lights in each row, the center light in each being white, those to left (or above, in the vertical row) are green, and those to the right (or below, in the case of the vertical row) are red. The apparatus provides for tests and registration of six movements as follows:

(a) Movements of stick from right, left, forward, and rear of neutral to neutral.

(b) Movements of rudder bar from right and left of neutral to neutral.

From these six single movements there may be combinations as follows.

Twelve combinations of two movements each.

Eight combinations of three movements each.

(2) *Run*.—As at present employed, the usual run of tests for each individual is as follows:

- (a) Stick from extreme right to neutral.
- (b) Stick from extreme left to neutral.
- (c) Rudder bar from extreme right to neutral.
- (d) Rudder bar from extreme left to neutral.
- (e) Combination of (a) and (c).
- (f) Combination of (b) and (d).

Each of the above movements is repeated about ten times.

(3) *Procedure*.—The procedure in conducting a test (as for example, (2) (a) above) is as follows:

- (a) Instructor switches off lights.
- (b) Candidate moves stick to extreme right.
- (c) Instructor switches on lights.

This action lights and brings into the vision of the pupil all the red lights in the right quadrant of the curved indicator. (At the same instant, the graphic recording mechanism begins to record time.)

(d) Candidate moves stick as quickly as possible to neutral, being guided in doing this by the successive disappearance of red lights and by the ultimate appearance of the white or neutral light.

(e) As soon as the stick is definitely centered in neutral, the recording instrument ceases to record time, the instructor switches off the lights and the movement is repeated.

(4) *Recording device*.—The recording device consists of a roll of paper and ink stylus. The paper is lined in the direction of the long dimension of the paper, the space between the lines being equivalent to the distance traveled by the stylus in $\frac{1}{2}$ second. The stylus travels from left to right across the paper at a constant speed of about $\frac{1}{2}$ inch per second. In the excursion from left to right it records so long as a red or a green light is showing on any indicator, but does not record when white or neutral lights only are showing.

(5) *Features*.—The salient features claimed for the test are—

(a) Signals are visual. In actual flying this is the sense which is of most value to the pilot.

(b) Required movements are easily explained and easily understood.

(c) Required movements are precisely the same as those used in actual flying.

(d) Recording mechanism is automatic and free from personal errors in recording time.

(e) Complete test as at present used in the R. A. F. takes but 6 minutes for each individual test.

(f) Recording is simple, short, and can be scored quickly.

(6) *Classification.*—The classification now used is—

(a) Promising.

(b) Average, “progress depending on improvability.”

(c) Below average, “unlikely to become satisfactory pilots unless great improvability is shown.”

(7) *Correlation.*—In correlation of performance on test with flying ability, of those classified as—

(a) Promising, over 80 percent were graduated and rated by flying instructors as above average.

(b) Average, tests on the apparatus were repeated at frequent intervals during the training period, and the improvement shown on the apparatus coincide closely with the improvement reported by the flying instructors. The percentage of graduates and rejections from this class is not known.

(c) Below average, 77 percent were rejected as below average by the flying instructors.

The classification or rating of candidates on the test is primarily on a basis of time, though consideration is also given to the degree of consistency displayed. The relative weight given to these two variables is not known.

(8) *Flying training.*—Based upon performance in flying training, candidates have been found to fall into three classes:

(a) Those who possess the necessary coordination.

(b) Those who do not possess the necessary coordination, but who possess the latent ability to acquire it.

(c) Those who possess neither the necessary coordination nor the ability to acquire it.

Claims are made that by means of the Reid tests, about 80 percent of all candidates examined can be correctly classified into the three classes. It is further claimed that the test will enable a skilled operator to select at least 90 percent of those in any given group of candidates, who, if accepted for flying training and started in on the usual course of instruction at a military flying school, would be killed in accidents or eliminated by the flying instructors because of inaptitude.

Men classified as (c) on the test should be eliminated immediately insofar as pilot training is concerned. Of those falling in (b), an indefinite percentage will if given sufficient time and instruction eventually become average pilots. However, the training of this

class of candidates as a whole will be a great deal more costly in time, equipment, and life than in the case of a similar number of (*a*) candidates. The training of a large number of (*b*) candidates in order to save for the service the few men among them who may eventually become average or above average pilots is considered a very costly and inefficient practice.

The personnel of any air service with few exceptions should be composed of pilots who are above average or exceptional in flying ability, and any training program which starts out with material heavily weighted with potentially average and below average flying material is both wasteful and uneconomical. Therefore insofar as possible training should be limited to those candidates falling in (*a*).

128. German.—Dr. Koschel of Berlin is a psychiatrist and probably as well qualified as any man in Germany to discuss air and aviation conditions having been in the service since 1901 when he started in balloon work.

In view of the fact that during the past few years altitudes have been reached which 10 years ago were undreamed of, he considered it highly desirable to determine to what heights the human organism could go on breathing rarefied air, poor in oxygen, without suffering any temporary or permanent harm, and also to test the mental efficiency at great heights, ascertaining the height limits up to which the flyer, even without any artificial supply of oxygen, is able to make reliable observations. Medical tests previously made in a free balloon (up to 9,000 meters height) were during the last few years continued in the aeroplane, under a parachute, and in the low pressure chamber, the last comprising the tests under discussion.

Up to a rarefaction corresponding to 7,500 meters height, Dr. Koschel had a number of assistants who took oxygen at different heights. At a rarefaction corresponding to an altitude of 8,000 meters, which is generally considered the limit of undoubted danger of life, he was the only experimenter and subject. In connection with several tests he had himself locked in the low-pressure chamber without any oxygen apparatus, the others observing him through the window. He lost consciousness a number of times and once suffered serious convulsions.

The following are the more important results of intelligence tests in diluted air:

Up to 5,500 meters apart from a certain fatigue and lassitude, no more serious trouble could be observed. At 6,000 meters the attention of one subject was seriously affected, the others to a lesser degree. At 7,000 meters the mental efficiency of all subjects was in every respect

impaired considerably. At 8,000 meters Koschel could only work for short intervals at a stretch, losing consciousness afterwards, and the work done by him at that height was very poor in every respect. When after a temporary condensation of air, the air was again rarefied, the same low degree of efficiency would occur at even lesser heights. Breathing oxygen for 2 minutes even at 7,000 meters height is sufficient to maintain the mental powers at a fair degree of efficiency for another spell of 10 minutes.

Whereas at 7,000 meters height subjects still succeeded in combining three ideas into a sentence, none of the subjects were able to number six ideas in accordance with their respective meanings. This striking fact is accounted for by the promptness and rapidity of the practically intuitive process of forming sentences on the one hand and the repeated mutual comparisons required in ranging six ideas on the other. None of the subjects were able to copy a series of eight letters or figures at 7,000 meters without error. Supplementing syllables in a text unknown to the subject would at 4,500 meters be done rapidly and without any mistakes, at 7,000 and 7,500 meters only one-half the text with very poor results was dealt with, and at 8,000 meters only a few syllables, irrespective of the meaning of the text, were filled in. The efficiency of written expression was impaired to an especially high degree. Apart from the fact that handwriting from 6,500 meters on became worse and worse, the same letters, words, or parts of such would at 7,000 meters be repeated over and over again, letters would be inverted, letters and syllables anticipated, while at 8,000 meters meaningless combinations of letters and syllables were made.

A phenomenon observed in connection with the records describing the subject's personal impressions, etc., was the frequent sticking of subjects to a given idea which over and over again would impose itself upon them, reappearing in a whole series of sentences.

The subject's retentive power (memory) from about 6,000 meters on underwent a disturbance which at 6,500 meters increased considerably. Even the ability to reproduce any personal experience prior to the test or anything learned with a special purpose, proved inadequate at 7,000 meters. After the test there was only a faint recollection of anything having occurred at 6,000 meters, while the remembrance of what had happened at an even greater height was practically nil, and even afterwards could not be revived without much difficulty.

Dr. Koschel claims that one of the most important results of his experiments is the proof that the feeling of personal comfort is by no

means indicative of the actual integrity of intellectual efficiency. In order to guarantee the reliability of his observations the flyer should in case of short flights commence breathing oxygen at 6,000 meters; in prolonged flights, at 5,000 meters at the latest.

Kronfeld devised a complex test in which the candidate has several tasks to perform.

In front of him a panorama rolled by which represented a landscape from a perspective of 2,000 meters. On this were designated a series of 30 artillery stations. This landscape was mounted on a kymograph drum and so could be presented continuously. A complete revolution was made every 2 minutes. The candidate observed this landscape through a sighting apparatus and his task was to "photograph" the artillery stations as they passed by a midline by pressing a reaction key. This constituted the chief task.

As a secondary task, he had to react to different colored lights which were flashed on around the central field of vision. For lights on the left, the right key had to be used, for lights on the right, the left key. The key had to be pressed once for a white, twice for a green, and three times for a red light.

Another secondary task consisted of listening to the sound of a motor and indicating by a call when the sound changed.

As a visual distraction, a sudden flash of light immediately behind the observer was introduced at the beginning of the eighth minute.

Reactions to the artillery stations and to the lights were recorded on a kymograph drum. The experimenter marked on the drum the time of acoustical stimuli and of the visual distraction. Auditory reaction times were not measured.

After practice in observing the artillery stations and reacting to the lights separately, the test was begun. For 4 minutes, the candidate had only to observe the landscape and react to artillery stations, then the secondary tasks were introduced and the test continued for 10 minutes. Thus, a measure of the effect of complicating the task was obtained. At the eighth minute, the visual distraction occurred. The system of scoring the results was arbitrary, and too complicated to be considered here.

Stern devised a complicated test which he thought gave more reliable results than simple tests. The observer was seated in the middle of a darkened room before a table which was rigged up with a series of levers. The ceiling and forewall each contained a series of electric lamps. The lamps on the ceiling were in metal housings which had forms cut out on the side toward the observer. These forms of two kinds were similar to one another and represented the

French and German ships. The size of the forms varied somewhat and the lights were of different colors. The lamps on the forewall were also in metal housings; these had varying numbers of point-formed holes bored out on the side toward the observer. Furthermore, a strip representing land upon which artillery stations were marked rolled by on the floor; this strip was lighted by an incandescent lamp so that the stations in passing were visible as distinct points. A sound hammer and an electric clock were also part of the equipment. The table before which the observer sat had six levers mounted vertically so that they could be turned forward or backward about 90° until they touched the table and made an electrical contact. The observer used the three right levers with the right hand, and the three left with the left hand. The two outer levers closed the circuit only if a contact was closed with the corresponding foot. Lamps could be lighted by the experimenter, singly or several at one time. A reaction had to follow only the presentation of lights showing the French ship, while to the German there should be no reaction. For each lamp a special lever movement was designated; for every sound hammer stimulus, lever 4 had to be moved forward; for every artillery station appearing on the strip of land, lever 4 had to be moved backward. A Hipp chronoscope in the circuit measured all reaction times to the light stimuli. Reactions to the artillery stations were recorded by a marker on a kymograph drum.

The observer was instructed to imagine that he sat in an airship. The analogy of the tasks to those of flying was pointed out to him in each case, then he was allowed sufficient practice to learn which movements corresponded with their respective stimuli, after which followed the first part of the test lasting 20 minutes. In the second part of the test another task was added, that of counting the lights as they appeared on the forewall. This lasted for 10 minutes as did the third part, in which comparing the number of points of two successive lights were substituted for counting. In all instances false reactions, failure to react, and reaction times were taken into account. The effect of distraction as shown in parts 2 and 3 was also considered.

The description of the Kronfeld and Stern tests was taken from "Aviation Medicine" by L. H. Bauer.

129. Psychology and pathology of Austrian Army aviator.—This report is a compilation of the observations and medical data of the most prominent Austrian authorities, psychologists and neurologists, among them Prof. Dr. Hermann von Schroetter, mem-

ber of the International Aeronautic Commission, and Prof. Dr. Wagner-Jauregg, Court Councillor.

To ascertain the requirements of the Austrian Air Service and to determine the qualifications of its personnel, it was necessary to study conditions at the front. Visits and observation trips by leading Army medical men to the "flights" at the various fronts were therefore instituted in the Austrian Army.

It was found that the physical and mental functions of the Austrian airmen were affected by the change from the normal soldier's routine, the difference in geographical location, and even by the peculiarities of the starting field. They were also affected by the varying climatic conditions, by nutrition, and accommodation of personnel and aeroplanes, and even by the personal qualifications of the commander and the other officers of the section. All these factors enter before the air weapon is taken into account. These components together are the genetic causes of the strange phenomenon known as the personal tint more or less marked in every aviation company and never found in other branches of the army. This phenomenon gives an excellent insight into the different needs and necessities of the air service and by means of comparison renders possible the selection and application of an improved organization.

By the empirical method of proceeding, it was also possible to obtain data on the phenomenon known as "being over-flown" (Ueberflogensein) and the strange nervous troubles resulting from flying.

Several high commanders of the Austrian Army complained of the unhygienic life, lightmindedness, carelessness, and even lack of discipline found among airmen. It is undeniable that the conduct of the officers and men of the aviation service at the front was different from that of other troops, and that in general they were more difficult to handle. This fact is related to and caused by the aviator's full consciousness of his being his own master in the air under all circumstances and in the feeling that he must depend on himself alone; furthermore, it is traceable to the perpetual mental tautness and concentration due to the constant and peculiar danger in which he is placed so that in the Austrian Army airmen were classed halfway between "professed heroes and hysterical women." However, the inspecting medical commissions found the circumstances much better than reported by various commanders. Airmen in combat sections were especially impressed with the desirability of leading a wholesome life free from all sorts of debauchery. The value of sports and sufficient sleep were emphasized. All flying companies had bathing and other sanitary facilities where all kinds of gymnastic

apparatus were put at their disposition and were used regularly by officers and men. The main meal without alcohol was in the evening.

In order to appreciate fully all the qualities required of the airmen, it is very important to hear personally of the mishaps, combats, etc., on the front as told by the pilot or observer himself. It would be of great interest for scientists and psychologists to read (or better still, if possible, to hear) the experiences of those who have been in combat. By classification of such reports it would be possible to select men possessing outstanding mental and physical qualities and to get a deep insight into the requirements of the air service. Such classification would bring out individuals particularly fit to serve as squadron and echelon commanders because of their ability to emanate and transfer to subordinates an enormous potential energy.

Not every airman is in full possession of himself under enemy fire. During the first combat flight in particular, certain mental suggestions and thoughts together with physical fright and even complete panic intrude to reduce the efficiency of the flight. Some fliers are in a sort of dream or nightmare; they shoot mechanically and only gradually grasp the situation sufficiently to act coolly. Some get rid of the oppressing and vexing tightness in the moment of danger and are undisturbed by secondary sensations and perceptions; they act then with full presence of mind and are even able to contemplate upon matters not connected with the danger of the flight.

In the majority of accidents, it is not the aviator's own danger which effects his nerves and his will power. What unnerves a man is rather the burning machine crashing to earth or the sight of death by a benzine fire of a comrade. Considering the demoralizing impressions of accidents involving terribly mutilated, burnt bodies, no more men than are absolutely necessary should be permitted to hurry to the scene of an accident.

Periods of mental depression crop up in spite of individual strong will power and iron nerves. The altered mental state manifests itself outwardly in an increased excitability, quarrelsomeness, outbursts of passion, lack of appetite, restless and perturbed ways, absence of mind, stammering or hasty speaking. In normal days these signs disappear.

Long service at the front does not pass without leaving its mark upon the men. Minds and tempers, formerly bright and glad, change; the aviator becomes morose, petulant or self-contained, and is often "not to be recognized." Hours of increased tension make the

men absent-minded, restless, low-spirited, and melancholy, and bring on a gloomy apathy and a weak-minded timidity.

In the first and second year of the World War, the air service, according to statements of a number of Austrian aviators, was a "down-right pleasure," especially on the vast plains on the Russian front, but since the use of incendiary and phosphorous munition was introduced and the combat tactics on the Italian front developed, it became "real hell."

The described nervous attacks sometimes last a short time, but very often effect permanently fitness of the men for air service at the front. Recovery, however, often sets in if the flying is suspended for a period of several weeks. The disconcerting phantasy born of fright fades and the impressions of personal and comrades' success get the upper hand. Zeal and self-confidence cure the psychasthenia.

From the medical point of view it is possible in some cases to verify objectively determinable symptoms of the nervous system and mind. In other cases it is not possible to find a sure indication that a mental trauma or a series of traumas have occurred.

The flight fatigue, fly shyness, phobia atmospherique show themselves only through the already mentioned sensations of insecurity, the imperative feeling "I must go down."

In order to evaluate fully and correctly the assertions of aviators it is necessary to know the previous history and personality of the aviator, and also to be informed as to his flying experience and accidents, if any.

Furloughs are very necessary in order to keep the picked personnel in the best of condition. During his leave, the aviator should not be allowed to come near a flying field, or to act as teacher or technical officer. A complete change of environment is essential, and therefore a place should be chosen where the man neither sees nor hears anything of the air service, and it is not advisable to domicile airmen in a special aviators' recreation home.

After having grasped the complicated mental life of pilots and observers and taken into consideration the great variety of fluctuations in their psychic equilibrium, it will be seen that the psychological examination of candidates for the service is not of such great value as heretofore. Such an examination has merely the informative value of a preliminary examination.

The chief importance in the selection of air personnel must be laid on the structure and condition of the nervous system and on the previous individual and family history. The psychic disposition, the efficiency and ability of resolution, and the readiness of the will of

the individual are not always equal. On certain days the individual feels he could perform difficult things with ease; on other days the same individual has imaginings and an increased disposition to frightened panic. In the laboratory tests, inferior men often behave quite otherwise than when in danger. It is evident that only through observation of the individual's actions at the helm by the flying instructor can a sure evaluation of the candidate's fitness be obtained, and not by a psychological examination.

Opinions differ as to the individualities and temperaments best fitted for aviation. Some consider as especially fit the calm, sober, prudent, reflective disposition; others, and among these, the tried competent aviators, prefer the type that demonstrates a quickly reacting nervous system. A prerequisite is complete control of the senses and the ability to concentrate the mind.

In order to obtain results approaching as nearly as possible the true psychologic reactions of a candidate, it would be of considerable value to give the psychological examination during a flight in an aeroplane. It would be easy to modify the present methods of examination so as to learn the degree of attention, diversion, faculty to concentrate, etc. By assigning tasks and problems for the candidate, and solutions during the flight, it would be possible to get his measure. The reaction and irritability due to fright would remain for laboratory examinations. Even this method of examination would never give the candidate's true action and reaction nor bring out his ability in the face of danger as surely as would a combat or observation flight over a battle area. It would be better, therefore, after the candidate has taken one or two trial trips, to send him over the enemy's line in a known terrain and to wait for the result. Such a practical examination would increase the coordination of the nervous reflex system of the individual and would harden him against physical and mental disturbances.

It is essential to keep a medical physical record of every man. This record should accompany him from the time of entrance into the service to the end of it. All personal experiences, accidents, the results of periodic medical examinations, and the observations of his superiors should be registered thereon. The records thus obtained would give the basis for further research into the preparation and development of psychological examinations for air service candidates.

The air service requires men of strong respiratory organs capable of resisting increased air pressure. Latent tuberculosis or disposition to it, chronic bronchitis, emphysemas, anaemia, the different forms of psychasthenia, and previous wounds were considered cause for

exclusion. Of great value is good, wholesome food. Indigestion and obesity restrict the capacity of the lungs and the alveolar tension and must therefore be avoided. Too much blood in the digestive apparatus after a hearty meal is also to be avoided, especially before a flight to a very high elevation. On the other hand, it is not enough to start out with only a cup of black coffee.

Flying itself, presupposing perfect physical fitness, is not injurious to the health if there is sufficient nutrition; it affects the physical and mental efficiency in the same manner as do all other outdoor sports, and seems to have a favorable effect upon certain nervous disturbances by its stimulating influence upon the vital functions. But there is a difference between flying as a sport and flying at the front. The latter often is injurious to the organisms as a whole in consequence of the constant mental tautness, the many excitements and dangers, aside from the nervous disturbances which follow.

Functions of the senses in the process of orientation in the air are not yet fully known, and it is necessary to analyze a series of experiments in order to settle the question. Some persons are sensitive to quick change of position and acceleration of speed and get seasick in spiral flights or in squally weather. Remarkable are the sensations when falling through an airhole (a sphere of decreased barometric pressure which occurs in squally weather or in summer). These sensations are somewhat similar to the feeling experienced on the bow of a steamer in a heavy sea or during the first moment of a downward starting elevator.

The airman's auditory organ is affected strongly by the noise of the propeller and especially by the quick change of atmospheric pressure. Equalization of pressure sets in easier at the ascent than at the descent, and it is therefore desirable to accomplish the descent as gradually as possible. Especially where the inclination of the individual is toward catarrh of the throat or of the bronchial tubes, it is best not to expose the auditory organ to unnecessary irritation.

Constant and accurate observation is an important factor for the observer and pilot who must search uninterruptedly the sky with its changing light and cloud effects. It is necessary to protect the eye from the disadvantageous effects of strong radiation and the harmful influences of draughts (convulsions of the eye muscles, conjunctivitis). After a few months of flying pilots complain of falling off of the strength of the vision, and of illusions at flights in high elevation. Sometimes horizontal nystagmus and scotomas were found upon examination. The scotomas usually have a circular form and are localized between 35° and 50°; they were traceable in 50 percent

of the men with long air service. It is remarkable that the men were not conscious of the defect (with one exception only). The use of colored goggles cures the disease in a few weeks.

It is not yet ascertained whether the electric state of the atmosphere, especially the ionization, influences the organism as does the increasing intensity of ultraviolet light at the ascent. For the solution of this question, it is essential to know whether the penetrating gamma rays do diminish with the elevation as supposed till now. On the contrary, these rays increase in intensity at a level above 3,000 meters, reaching as high as 24 ions per cubic meter.

At high levels or in great cold, air men often show an increased dysuria (strangury), which is a symptom of nervous exhaustion.

Fluctuation of the degree of moisture in the air and the aridity in high altitudes influences the skin and mucous membranes.

Repetition of irritation and depression not only cause temporary neurasthenia, but also lasting exhaustion of the neuro-muscular reflex system. The nervous strain on the whole constitution influences the heart, especially if that organ is an inferior one which has been weakened by previous illness, or if there exists thyroidism, or if the individual is lymphatic. Such conditions develop into heart neurosis and vasomotor disturbances.

Aviators who complained of insomnia, palpitation of the heart, oppressive feeling, and cardialgia showed cardiovascular hyperexcitability, striking lability of the heart beats during emotional moments, respiratory arrhythmia and similar symptoms, but no marks of influence upon the heart regulation and especially no extrasystoles. These disturbances of the heart arising from mere psychic injuries show distinctly their connection to mental traumas, as all persons who were examined along these lines never complained of troubles of the nerves of heart. It is therefore to be assumed that the increased claims on the mental life operate in an accumulative manner by reflex process upon the heart and its rhythm.

The result of physical and mental overexertion sometimes remains limited to the psyche and finds its vent in an irritable weakness or dejection without producing any affection of the heart. The individual's constitution, ancestry, temperament, and disposition must be taken into account and can be checked from the above.

Over-flown or fly-shy pilots generally complain of the following: Decline of the ability of orientation and equilibrium in the air, fluttering of the eye lids, diverse paraesthesia, hypersensibility of the skin (dermography), hyper-trophic reflexes, tremor, striking lability of the pulse, tachycardia, mental irritability, quarrelsomeness, morose

temper, headaches, and insomnia. Professed tremblers or men with functional paralysis have not been seen among aviators.

In regard to the determination of the injuries caused by aviation, it must be said that neurosis originally arises from a traumatic endogen base, from variation of the structure in the central nervous system (hemorrhages) or from similar causes. On the other hand, a number of cases of neurosis have arisen from purely psychogenic and endogenous causes. Finally, it is possible for symptoms to arise caused by a combination of the two above described sources such as the case where a previous organic change caused a peculiar mental disturbance with symptoms of an ostensible functional character. A derogatory influence is always to be imputed to excessive use of black coffee, alcohol, and cigarettes.

SECTION XVIII

AMERICAN RESEARCH

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130. Tests used by psychologists in the A. E. F.—a. General.—Monitors and pursuit pilots were examined in the laboratory at the 3d Aviation Instruction Center. The tests consisted of a general physical examination, the standard rebreather, simple reaction time to visual, auditory, and tactual stimuli, and a steadiness test. Observers were examined at the 2d Aviation Instruction Center. They were given, in addition to the rebreathing test, a new test devised for testing the speed reliability and confidence of observers.

b. Results.—(1) The results of the rebreathing tests were compared with the results obtained in the United States. While the latter were made on cadets and experienced men alike, the oversea group were all selected men and the unfit had been eliminated. Comparing the numerical scores of the men tested in the United States with those in the A. E. F. the former had a slight advantage, but this was doubtless due in part to the variations in the psychologist's ratings. Some were over cautious and some were too lenient.

(2) The most interesting feature of the results obtained on the rebreather overseas is the relatively late appearance of the attention effects as compared with the appearance of the motor effects. Whether this difference is due to the fact that the monitors and pursuit pilots were a selected group with inferior aviators eliminated or whether it is due to their extensive training, it is impossible to determine from these results. However, in this respect, the selected and the general groups are distinctly different. It was evident also that the attention was maintained at the expense of voluntary coordination by a greater concentration of effort upon the former as the numerical scores were not high. If further investigations should show that the superior aviators possess greater powers of attention or are capable of greater attention at the expense of motor effort, the rebreathing test might throw some light upon the qualifications of the good flier in addition to this endurance of low oxygen.

131. Reaction time.—Reaction time tests were the same as those used by the French, and the correlation between the reaction time of the subjects who were pursuit pilots and monitors and their training department rating should indicate the value of the tests. Instead of 10 reactions to each stimulus they used 25 as that gave a more reliable record of performance. The results were as follows:

The mean reaction times to all stimuli were somewhat higher than the French and the individual variation from the average greater.

Dividing the men into the fit and unfit classes according to medical examination, while the unfit pilots present the longest reaction times, they also present some very short ones, and if the reactors with an average time of .200 second were eliminated as the French advise, only one man who was unfit would be eliminated.

As to the correlation with flying ability, owing to personal bias and other factors which might enter into ratings a man might be misplaced in one or more classes in either direction. The correlations though small are significant and indicate that with a more accurate rating scheme a higher correlation might be found.

In the opinion of the examiners, a simple reaction time test alone should never be used in the selection of candidates. They say that mental processes undoubtedly involve elements that cannot be measured by a single reaction to a known stimulus which is attempted in the simple reaction experiment. Choice reactions involving discriminations, varying degrees of judgment, etc., might yield important results.

132. Steadiness.—A subject standing erect is required to hold a stylus the size of a lead pencil in a small hole in a metal plate. The

plate is adjusted so that it is on a level with the subject's eyes. The stylus is connected with the pole of the battery and the plate with the other. When the stylus touches the edge of the hole, a contact is made which is recorded on the kymograph drum. In these tests the subject was required to hold the stylus in the hole for a minute with his arm kept free of his body. He was to breathe normally as holding his breath would cause unsteadiness before the minute was over. Four holes were used, the smallest of which was $\frac{3}{16}$ of an inch in diameter. The groups were arranged according to the degree of tremor in the smallest hole, group 1 being those who showed a few scattering contacts, group 5 those who showed practically a continuous tremor. Correlating this degree of tremor with training department ratings, the result was plus 0.725 plus or minus 0.181, which indicated that the best fliers showed the least unsteadiness. This corresponds with the British view. It has been said "tremor may be indicative of chronic indigestion or alcoholic excess; but uncertainty of the fingers, especially when they are abducted and brought together again is a certain sign of lack of control. Tremor is not so much an indication of a neuro-pathic temperament as of a definite disturbance of function. But apart from alcohol, it is one of the commonest signs of stress of war service."

133. Observation report.—The officers in charge of the unit were convinced after conferences with instructors at the 2d Aviation Center and after hearing reports and discussions on the nature of aerial observation and the type of men best suited for it, that because of the demands upon him and the importance of his work, the observer should be a man carefully selected and trained to an even greater degree than the pilot. The duties of the observer include missions in regard to air activity, visual reconnaissance as well as all matters of military importance taking place on the ground. These tasks are particularly difficult when the clouds are hanging low. To detect the activities of the enemy who may be taking advantage of the clouds to move troops or convoys, the observer flies to the place he wishes to observe, dives down through the clouds, gets what information he can, and then goes on to another point in the same manner. When coming out of the clouds he must instantly orient himself besides making detailed and accurate observations. The test here described was devised to reveal individual differences in quickness, accuracy, and certainty of the observation of a situation requiring study, and especially of the nature and relation of parts, of its recall, and of its recognition when again presented.

A series of aluminum slides 16 centimeters square was prepared and each ruled off into 2-centimeter squares. At 6 or 7 of the 49 cross lines holes 5 millimeters in diameter were drilled. These holes were covered with red, green, or white paper. When lighted from behind the lights appeared as colored disks on a black surface. The slides could be changed and the subject, who sat about 1 meter away from the box, could by pressing a key keep the box lighted as long as he wished. He studied the arrangement of the colored disks in their relation to the border and to each other, and when he had signified that the slide was learned, the light was turned off and he plotted their positions on coordinate paper in the shortest possible time.

The experimenter noted various factors, the time required for study, time to report, accuracy of report, number of trials necessary for accuracy and confidence of report, etc. When this part of the test was finished, the slide was removed and other slides inserted, the original slide appearing at different times, the subject identifying it as the same or different.

As the method of rating was rather complicated, it is not necessary to go into it here, but on the basis of their ratings as successful observers, the subjects were divided into two groups, those rated 1, and those rated 2 and 3. The first group was decidedly quicker than the second in recognizing the slide that had been studied and mapped. The other results because of the training ratings could only be indicative of the value of the test if used under more exacting conditions. If it could be correlated more strictly with ability in visual reconnaissance, it would seem to be one quick and trustworthy method of selecting men for this important branch of the work.

Aside from laboratory methods for getting at the qualifications that make the successful flier, the laboratory sought to get an insight into the temperament and personality of the men by systematic interviews, and more particularly by the arrangement made by one of the men who took the R. M. A. training and was put on flying status. When assigned to flying duty he identified himself completely with his outfit, and in every way conformed to the necessary routine. In this way he was able to meet more intimately hundreds of flying officers who talked much more freely than they ever would at the laboratory.

The general impression gained was that flying demands and encourages a degree of individualism unknown in any other branch of the Army, something which has been given full recognition in the French and especially in the British service but too often not in that of the United States. In learning to fly as in the acquisition of

any complex act of skill there are definite periods of lapse in improvement due to certain difficulties in adjustments of the organism, and also to the change of attitude of the learned. The former should be understood by the instructors and others directly in charge of the cadet's training, as it would be of assistance in preventing accidents as well as in judging the cadet's ability. The attitude of the cadet is largely influenced by his success but also by the physical conditions surrounding him such as quality of food, recreation, and the relation to his superior officers. As he says, there are times when the aviator does not feel like flying not due to any lack of willingness or desire to fly, but due to an inability to pull himself together. It is a common belief among aviators that they should not be compelled to fly at such times. There is no doubt that often this feeling can be overcome especially during emergency, but it is equally certain that it should always receive due consideration during the first weeks of training, and should be thoroughly understood by those in charge of flying.

As to personality of the flier, no general rule can be given. Quiet, methodical men are among the best fliers. What is most needed is intelligence, the power of quick adjustment to a new situation, and good judgment. The pilot does not need to be so quick in motor adjustments provided he thinks quickly. The nervous, high-strung individuals or those bordering on the temperamental are the least reliable for they are most likely to become psychotic under stress, though they often become good fliers.

While the earlier work in this country followed closely that of Europe, many additional tests were developed such as the perception of gradual tilt, steadiness as measured by a marker attached to the top of the head recording on a smoked drum, ability at judgment of curves, and performance tests of various kinds.

134. Psychological tests in selecting trainees.—a. General.—

(1) *Purpose.*—Experiments were again started in 1926 at the School of Aviation Medicine, Brooks Field, Texas, with psychological tests for aviators. The purpose was to discover objective measures which might be used as an aid in the selection of personnel for training in military aeronautics, or at least to reject such applicants as were obviously unsuited for flying training.

(2) *Subjects.*—The subjects selected for the experiment were the students (officers and flying cadets) reporting for training at the Primary Flying School. The group was highly selected as to physical and educational qualities but otherwise unselected except for age. Only second lieutenants and flying cadets were used in the study.

The object of the work was to determine if a psychological test could be used in an emergency as an aid in selecting men for flying training. In the event of war, the Air Corps will obtain most of its personnel for training from the younger age group, and it was considered best to use only that age group for this study. Age is undoubtedly a factor in learning to fly and every effort was made to limit the variables to as few as possible.

(3) *Records*.—All the tests were given before the students began flying training. Scores were computed for each student and filed with the individual medical record. All records were kept confidential until the student was either eliminated or graduated from the Advanced Flying School. The test grades were not known to the flying department and were not a factor in the success or failure of a student. Only the records of those students who either graduated from the Advanced Flying School at Kelly Field, Texas, or were eliminated for lack of progress in flying training were included in the group for study. The records of those students who failed to graduate for reasons other than deficient flying ability (such as academic failure, resignation, disciplinary action, or death) were not included in the study.

b. Thorne reaction time—(1) *Apparatus*.—The experiments were started with the Thorne reaction time apparatus. This machine was developed in 1925 by Lieutenant Colonel Frederic H. Thorne of the Medical Corps. It measured simple and discriminative reaction time in hundredths of a second. The candidate received a visual or an auditory stimulus to which he had been instructed to respond by pressing either a right or left hand telegraph key. All errors were recorded and the time of each reaction measured. The final score was based upon the number of incorrect reactions (errors) and the average time of the correct reactions for the completed series. Use of the test was started in 1926 and was in constant use until 1930. It was given as a routine to students reporting for training at the Primary Flying School, and 1,274 students who took it were considered in the study. Of the number tested, 468 were graduated from the Advanced Flying School, Kelly Field, Texas, and 806 were eliminated either at the Primary or at the Advanced Flying School for "failure to make satisfactory progress in flying training."

(2) *Scores*.—The scores on the test ranged from .35 seconds for the best or quickest to .79 seconds for the poorest or slowest performance. The relationship of these scores on the test to graduation is shown diagrammatically in figure 2. The students were arranged on the chart according to rank on the test. A class interval of 5 was used.

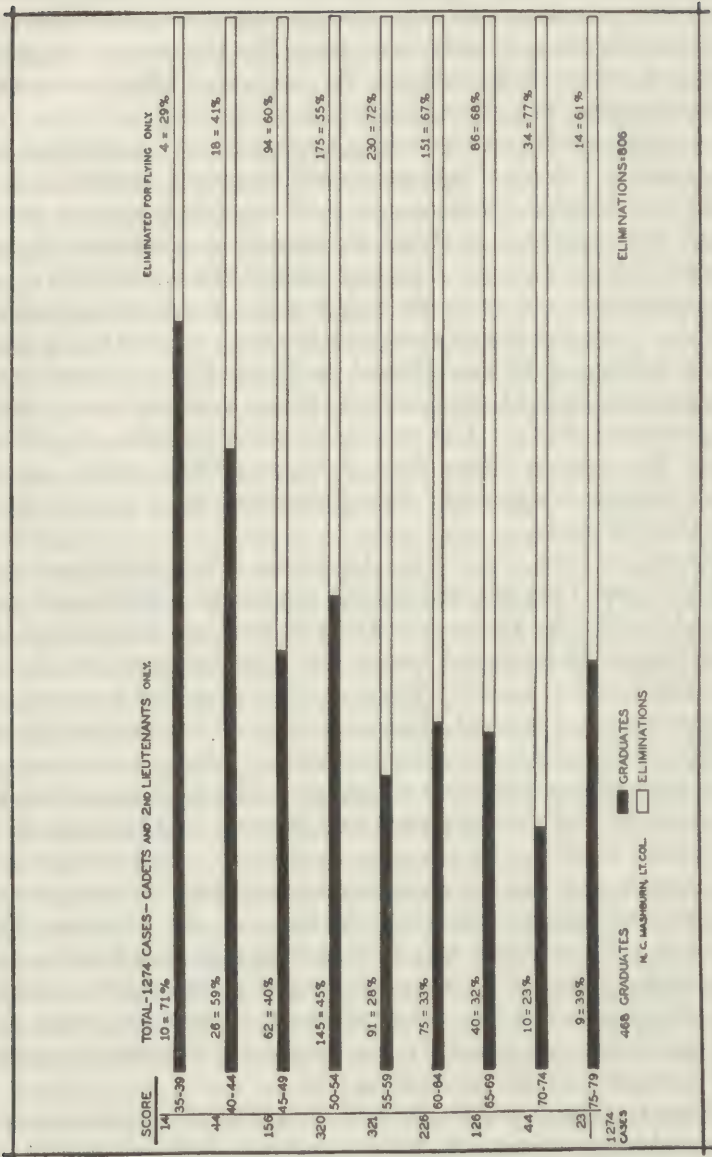


FIGURE 2.

The group in class interval .35 to .39 shows 71 percent graduates while the poorest group in class interval .75 to .79 shows 39 percent graduates. The chart indicates a fairly constant relationship of the scores to the percentage of graduates. As the performance becomes slower as indicated by the increase in the size of the score, the percentage of graduates is progressively decreased. The curve showing the general relationship between these two variables is not smooth. This irregularity is probably due to chance disturbances, and to the small number considered in the respective class intervals. The probability of graduating is about twice as great for students appearing in the top class interval as it is for those in the bottom interval.

c. Complex coordinator.—(1) *Apparatus.*—Later, in 1927, experiments were started with the complex coordinator. It was constructed in 1926. The apparatus consisted of an adjustable seat and a set of airplane controls mounted on frame in the same relationship as those found in an airplane. The stick did not have fore and aft motion. In front of the controls was a panel on which were mounted four rows of parallel lights, eight lights to the row, and two pairs of lights, one pair of which was placed in the center above and the other pair in the center below the parallel rows of lights. The two upper rows of lights were red and the two lower rows were white. The upper and lower pairs of lights were green. The red lights were the stimulus lights and under control of the operator. The white lights were the response lights and were controlled by the reactor. Only one white light was activated at a time and lighting of these was synchronized with the movement of the controls, the upper row being controlled by the stick and the lower row by the rudder. The degree of tilt of the stick from the vertical or the degree to which the rudder was moved from the central position were indicated by the white light which was activated. The white lights guided the reactor in the movement of the controls while responding to a stimulus. The upper pair of green lights informed the reactor when he had responded correctly to a stimulus. The correct response blanked out the light and it remained out as long as the correct response position was held. The lower pair of green lights informed the reactor when the controls were centralized or in neutral position. When both the controls were in neutral position both lights were on; when moved out of neutral position the lights were out. One green light of each pair had to do with movements of the stick, and the other one with movements of the rudder. On the opposite side of the signal panel was the operator's switchboard.

This consisted of 36 toggle switches. These switches were manually operated and controlled the signals and the recording device.

(2) *Instruction.*—During the instruction period the reactor was taught the relationship of the movement of the controls to the white lights, and correct responses to each of the three signals consisting of a single red light, two horizontal red lights, and the buzzer. When the single red light appeared, the subject was instructed to move the stick so as to light the white light directly beneath the single red light. As he did so, the upper left green indicator light was extinguished. He held the position with the stick until another signal appeared. When two horizontal red lights appeared, the subject was instructed to move the rudder so as to light the white light directly beneath the right-hand red light of the two. As he did so, the upper right green indicator light was extinguished. He held the position of the rudder until another signal appeared. When the buzzer sounded he was instructed to move controls (stick and rudder) so as to light the fourth light from the left in each row of white lights. As he did so, both green indicator lights were extinguished. He held the position with the controls until another signal appeared.

(3) *Composition.*—The complete test was made up of five series with a short rest period between each. The first series consisted of 6 reactions with the rudder, the second series 6 reactions with the stick, the third series 20 reactions with the stick and rudder combined, the fourth series 15 reactions with stick and rudder combined, and the fifth series 15 reactions with the stick and rudder combined, making a total of 62 reactions in all. It required about 15 minutes to give the complete test.

(4) *Recording device.*—A complete record was made of each subject's performance on the test. The recording device used was a standard six-pen chronoscope; the two central pens recorded the time of each reaction in hundredths of a second. One of the central pens recorded time for the stick and the other central pen recorded time for the rudder. The four lateral pens recorded errors. After the test was completed, the time of each reaction for stick and rudder was measured for the 62 signals. The errors were many and each was counted and classified. After rating and scoring the tapes the student was given a grade which was the actual time of his performance in hundredths of seconds. The administration of the tests and the scoring of the tapes was done by the same person.

d. Report.—The present report is based upon a score computed from complex reaction time only. There are other factors recorded in the

test which may have as much value in determining flying aptitude as complex reaction time, but they have not been considered.

(1) There were 1,394 students considered in this study. The score range was from 1.33 seconds for the best to 4.76 seconds for the poorest. The average score was 2.29 seconds, and the median score was 2.13 seconds for the group. The distribution of scores closely approached that of the normal curve of distribution.

(2) There were so few students in the class intervals at the extreme ends, that it was decided to group all those with scores lower than 1.50 in the class interval 1.50 to 1.59, and those with scores greater than 3.00 in the class interval 3.00 to 3.09. The group appearing in the top class interval which represents the best performance on the test shows 74 percent graduates, while the group appearing in the bottom class interval representing those with the poorest performance on the test shows only 14 percent graduates. Hence, the probability of graduating is about five times as great for those scoring in the first group as it is for those in the last group. The figures indicate a definite relationship of scores to graduation, and it may be assumed with reasonable assurance that this relationship is caused by some common ability involved in both the test and learning to fly an airplane. If the grouping was due to chance, the percentage of graduates should be approximately the same for each class interval.

Inspection of the figures indicates that the critical score should be located at about 2.40. Of the 932 students scoring in the preferred range, that is, in or better than the class interval 2.30-2.39, 472 or 51 percent graduated, while of the 462 scoring in the critical range, that is, below this class interval, only 110 or 24 percent graduated. If 462 students scoring in the preferred range had been selected for training in place of the 462 students scoring in the critical range, it is logical to assume that 241 (51 percent) graduates would have been obtained instead of the 110 (24 percent). This would have meant a gain of 131 trained pilots to the service.

135. Constable automatic serial action apparatus.—While working with the Thorne and O'Rourke apparatus at the School of Aviation Medicine, Brooks Field, Texas, during the years 1927 to 1931, it was decided that an apparatus involving the principle of serial action might have greater possibilities in detecting potential flying ability than the tests then being used. With serial action as the basic idea, the apparatus described below was designed and constructed.

a. General description.—(1) The apparatus is automatic and designed to present a continuous series of stimuli. The responses to

these signals are made by a coordinated movement of a set of controls operated by the hands and feet. The correct response to a set of signals automatically sets up the succeeding signals until the whole series is completed. A reactor's score is the total time required to run through the complete series.

(2) The equipment consists of a frame 60 inches long, 29 inches wide and 18 inches high, in which are mounted an adjustable seat and a set of airplane controls. In front of the controls is an upright section 64 inches high and 36 inches wide.

(3) The signal panel is mounted on the upright section and consists of 3 double rows of parallel lights, 13 lights to the row. Two rows of the parallel lights are curved, two vertical and two horizontal. One row in each set of lights is green and the other row white. The green lights are the signal lights and work automatically. The white lights are the response lights and are under the direct control of the reactor. Only one light is illuminated at a time. These white lights are controlled by the movements of the stick and rudder. The curved row of white lights is controlled by the lateral motion of the stick, the vertical row by forward and backward motion of the stick, and the horizontal row by the motion of the rudder. On the other side of the upright section are three relay switches and the automatic signal selector. The selector unit consists of a commutator disk, brush holder, shaft pulley, wheel, ratchet, pawl, and solenoid. The electric current is supplied by a 12-volt storage battery. Six volts are used to activate the lights and relays and 12 volts the solenoid. The relays are of the conventional 6-volt, 20-ohm type.

(4) The commutator disk consists of 4 circular rows of contact heads, 40 contacts to the circle and 4 rings mounted in a micarta plate disk 10 inches in diameter. The brush arm holder is mounted on the shaft and has 8 brushes. These brushes serve to bridge the electrical gap between the contact heads and the rings of the commutator. At each stop the brushes bridge a break in the electric circuit and activate a set of signals.

(5) The solenoid is a 12-volt type and works a pawl. The solenoid is activated and releases the escapement only when the reactor has made the correct response to a signal.

(6) The ratchet is mounted on a steel shaft and has 40 stops. The brush arm holder is synchronized with the movements of the ratchet wheel. At each release the ratchet wheel and the brush arm holder revolve 9° in a clockwise direction until checked by the next stop. The pawl is energized by the solenoid and allows the shaft to rotate

one point at a time. The pulley wheel is of metal and is anchored to the shaft.

(7) The controls are of the type commonly used in the primary training airplanes. To the lower end of the rudder is attached a brush holder and a segment of a commutator with 13 contacts, mounted in bakelite. To the lower end of the stick are attached two brush holders and two segments of a commutator with 13 contacts each. One segment of the commutator has to do with aileron movements of the control column, and the other with elevator movements.

b. Operation instruction.—To operate, the subject is seated in the chair and given the standardized instruction relative to the procedure in administering the test. Attention is directed to the operation of the controls, and that the illumination of the white lights are controlled by the reactor and synchronized with the movement of the stick and rudder. When a green light appears on the signal panel, the reactor is directed to move the controls as quickly as possible so as to light the white light opposite the green light. There may be one or more green lights appearing at a time. When the controls are moved to the correct position in response to a set of signals, this closes the three relay switches, allowing the 12-volt current to flow through the solenoid, releasing the escapement which allows the shaft and brush holder to rotate 9° , setting up another set of signals. The subject is allowed a reasonable length of time for practice. The first stimulus is set up by the operator but thereafter the operator is completely removed from the test. New signals are automatically set up by the reactor as he makes the correct response to the preceding ones. The reactor establishes his own work speed and penalizes himself for all errors.

c. Recording.—The recording is simple and may be accomplished by any of the standard polygraphs. The test may be scored as a work limit test, that is, the total time required to complete a standard series, or it may be scored as a time limit test or the number of items completed in a specified time.

d. Advantages.—The advantages of this test are—

(1) Serial action is involved instead of the classical single reaction.
(2) Stimuli are automatic and mechanically controlled, eliminating many variables such as—

(a) Possible errors of operator.
(b) Encouragement or discouragement of the reactor by the manner in which the signals are set up by the operator.

(3) Automatic features eliminate necessity of a highly trained operator.

- (4) Standardization of procedure is greatly simplified.
- (5) Performance is continuous without chance for rests.
- (6) Stimuli are constant in intensity.
- (7) Minimal distraction by moving parts.
- (8) Action of the mechanism is quick and the speed is constant.
- (9) Mechanism is simple, making for increased reliability.
- (10) Measurement is time consumed in one complete and errorless act, that is, any errors which may have occurred must have been corrected before the act is complete.
- (11) Obviates attempting to weight errors.
- (12) Relationship of test to piloting an airplane close enough to bring forth the best effort of the student.
- (13) Ease of recording and scoring.
- (14) Test is short, allowing it to be repeated on different days.

e. Test performance.—(1) In 1931 the actual work with the serial action apparatus was started. The procedure followed was essentially the same as that followed in the reaction time and complex coordinator work described above. Personnel chosen for the test was again limited to second lieutenants and flying cadet trainees. All test records were discarded except those on the students who either graduated or were eliminated for "failure to make satisfactory progress in flying training."

(2) There were 1,713 cases considered in this study. The score range is from 2.50 to 15.00 minutes. This is ample for statistical study. The distribution of scores closely approximates that of the normal.

(3) There were so few scores in the class intervals at the extreme ends that it was decided to group all those with scores less than 3.00 minutes in the 3.00- to 4.00-minute interval, and all those whose time was slower than 8.16 in the 8.16+ -class interval. There were 35 students of the group studied whose scores fell in the top interval and 68 students whose scores fell in the lowest class interval. Training records of these two groups show the following results: Of the 35 in top group, 27 graduated and 8 failed or 77 percent success and 23 percent failure, while in the lower group 11 graduated and 57 failed, or 16 percent success against 84 percent failure. The probability of obtaining a trained pilot from a group of applicants whose scores on the test fall in the upper class interval is about five times as great as the probability of obtaining a trained pilot from a group whose scores fall in the lowest class interval.

136. Cost of training.—The cost of training a military pilot is not known, nor the cost of attempting to train students who fail.

It is known that a large part of the training expenses of an Army pilot is caused by trying to train students who fail. Statistics show that it requires on the average of about 60 days to induct a flying cadet into the service, demonstrate his inability to learn to fly, and return him to civilian life. As was said above, this expense is not known, but assume it to be about \$2,500, that is, each flying cadet who starts training and fails to make satisfactory progress in flying training and has to be eliminated costs the Government about \$2,500 per man. If this figure is applied to the two groups that is, the top and bottom groups, the eight men in the first group who failed to graduate cost eight times \$2,500 or \$20,000. If this amount is prorated among the 27 who graduated in the group about \$740 of the expense of obtaining a military pilot in this group is the result of attempting to train the eight men who failed. In the bottom group there were 57 failures costing \$142,500. Prorating this amount among the eleven graduates there is about \$12,954 which must be added to the expense of each of the 11 pilots as a result of attempting to train the 57 who failed. Each pilot obtained from the lower group cost about \$12,214 more than one obtained from the upper group.

If 100 students had been selected for training whose scores were in the top range 77 graduate pilots would have been obtained, while a like number selected from the lower range would have given only 16 graduate pilots. This is an advantage gain of 61 pilots in favor of the upper group. In an emergency of war where the time factor is of such great importance, this gain in pilots might prove of inestimable importance.

137. Results.—It has been found that all the members of a group ranking high on the test are not successful in training. This indicates that there are other factors important in learning to fly which are not being measured by these tests. Again, all members of a group who rank low in the tests do not fail to graduate. This is more difficult to explain. It may possibly be due to errors in the technique of giving or rating the tests, or the individual may have other unusually favorable qualities which compensate for the deficiencies measured by these tests. The emotional factors are of paramount importance in learning to fly. They are not measured by these tests, and it is doubtful if a laboratory test for emotions can be developed which will be of practical application in the selection of military flying personnel.

There are no criteria of flying ability available nor has there been an attempt to establish any. Evidence of graduation from the ad-

vanced flying school is the criterion of success used in this study. No attempt has been made to work with aeronautical ratings of students or pilots. In beginning the experiments with psychophysical tests, it was not with any assumption that they must of necessity distinguish promising from unpromising candidates. Rather the investigation aimed to put the test to trial under strict scientific conditions, and to find out whether they actually gave evidence of value. It was desired to know if there was any parallel between the degree of success with which a student could pass a given psychophysical test and that person's success at graduating in a military flying school.

A study of these data indicates that in practical application, performance tests have value only in a negative way. A good score on a test is not a positive indication of aeronautical ability, nor does it convey positive assurance that if selected the applicant will be successful in training. However, it does indicate that the candidate is endowed with certain abilities essential to making a good score on the psychophysical tests, and experience has taught that these same factors are essential to success in flying training. In the selection scheme a student with a good score on the performance tests then would be classed as a good prospect. On the other hand, a poor score on the tests does convey very definite and valuable information. It indicates the applicant to be deficient in certain abilities which are involved in making a creditable performance on the tests as well as necessary progress in a military flying school. As a result of these deficiencies, the chances of the candidate being successful in training are greatly reduced. In the selection scheme he would be classed as a poor prospect for training.

In presenting the results of this study, it is not with any idea of doing away with any part of the several examinations now being used in selecting aviators, but rather to supplement these examinations by some such objective tests already of demonstrable value, and to stimulate an interest in the development of other tests so as to reduce, if possible, the large percentage of failures now occurring under the present system of selection.

A study of the performance records of 3,375 students who were given psychophysical tests at the Primary Flying School demonstrates the possibilities of these tests as a means of assessing a student's potential aptitude for flying training. The experiments prove that the method is sound in principle and promises to be therefore a valuable aid in the original selection of applicants.

SECTION XIX

FUNCTION PERTAINING TO AVIATOR

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138. Function.—The function of psychology with respect to the aviator may be considered as twofold. The first is the selection of the aviator with regard to his adaptability to the work required of him, and the second is maintenance of psychological fitness to fly.

a. Selection.—(1) *General.*—After it is determined that the candidate is physically qualified for aviation, it is the task of the psychologist to determine the conscious action of the organism with regard to the adaptations which contribute to making a good flier. Past experience has proven that certain psychological types make good as flyers while others do not; therefore, it is the task of the psychologist to choose the psychological types which have been successful in the past and to discard the types which have proven unsuccessful. This includes determining the aviator candidate's adaptability to one or another set of requirements for the different branches of flying.

(2) *Necessary attributes.*—Roughly speaking, it is essential that the aviator possess—

(a) *Perception.*—Perception is the ability to perceive quickly and accurately through the various senses, visual, auditory, etc. This depends not only upon the perfection of the sense organ, but upon quick and accurate integration by which useful and perceptual reactions are achieved.

(b) *Good memory and associative thinking.*—Associative thinking depends upon retentiveness and expresses itself in the various forms of judgments and decisions. The memory traces or engrams must be sufficiently labile and near enough to consciousness so that the cognition of associative thinking is rapid and accurate and so little influenced by abnormally accented affects of conscious and unconscious complexes that the results of the engrams are correctly evaluated with the present experience. The total results of this associated thinking process ends in correct connotation or in the physical reactions required to successfully adapt to the stimuli of the situation considered.

(c) *Maintenance of equilibrium and orientation.*

(d) *Normal rapidity of learning and habit formation.*—Includes a labile and plastic learning faculty for the quick formation of association pathways giving correct and successful reactions. The correct

habits are quickly acquired and incorrect ones easily and quickly discarded.

(e) *Normal emotional response*.—Emotions are directly connected with the driving power of the organism and are most important in all mental processes.

(f) *Control of voluntary ability*.—Varies in expression according to variations of environment.

(g) *Attention*.—Includes the extent to which a flyer can concentrate upon the work at hand, and the length of time during which the important details of a situation can be attended to, regardless of distraction.

b. *Psychological fitness*.—In everyday intercourse with flyers under general service conditions it has been found that a man may be quite an efficient flyer while having physical defects, but under psychological handicaps he invariably comes to grief. Thus, the secondary function of psychology with respect to the aviator is to see that he is kept psychologically fit to fly. Each individual case is a separate and distinct entity unto itself because no two psyches are the same. Although the same general laws apply to all as a tent covers a crowd, each one is individually covered by his own clothes. Because of his phylogenetic and psychogenetic development each individual is a separate entity psychologically however much he may conform to the general herd laws.

Man flies at a faster speed and a much greater height than any of the birds. But, while with birds flying is a natural process, with man the air is an unnatural environment. By mechanical contrivances man conquers the air. He takes to himself artificial wings which must be watched constantly and always subject to his will. This calls for very agile exercise of his intellect, unfailing will power, and above all complete control and guidance of his emotions. The physiological processes of the human organism do not change fast enough to permit the human body to adjust itself adequately to the different temperatures, varying air pressures, oxygen tensions, and other environmental changes. Because of this must be determined as nearly as possible before the man actually flies his psychological and physiological reactions to the stresses of flying. This is done by use of artificial means, the low pressure chamber and the rebreathing machine. By these methods endeavor is made to determine the length of time and the degree of success a man can psychologically combat a steadily increasing physiological handicap.

139. Effect of oxygen deficiency.—There has been some work done in the low pressure chamber to show the effects of oxygen

deficiency upon handwriting, muscular coordination, memory, judgment, etc. Most of the German work in aviation medicine has been done with the low pressure chamber, but the great majority of work of this nature has been done on the rebreathing apparatus. With this apparatus it is possible to reduce the oxygen tension in respired air equivalent to the tension for any elevation up to that at which the subject can no longer endure the deficiency.

There are wide individual differences in resistance to deprivation of oxygen which are shown by first, the extent of deprivation which can be endured for a given time and second, the length of time a certain extent of deprivation can be endured without exhibition of symptoms of deterioration of behavior. Both factors are quite important. The one would apply especially to the man who was doing rapid combat work at great altitudes which would involve rapid changes of position with wide variations of altitudes, the other to the man making long bombing trips at moderately high altitudes.

a. Deterioration of behavior.—Three features of deterioration of behavior requiring mention are—

(1) *Disturbances of muscular coordination.*—These are shown by most subjects when the oxygen supply is diminished to an absolute value comparable with that existing at twelve to thirteen thousand feet, more or less according to the individual. The finer coordinations are first impaired, this being manifested by tremulousness or inaccuracy of adjustments or both. Various compensatory tendencies are likely to appear. These may consist in changes in the character of the movement involving a different musculature, or by increased speed or forcibility of the original movements. If the deprivation is sufficiently increased, a point will be reached at which the responses become inadequate despite the compensatory tendencies. Often coordination fails completely, the subject makes slow, hazy fumbling movements with great effort, then purposive movements fail entirely and he sits quiet and lethargic like a stuporous case of catatonic dementia praecox. Then oxygen must be administered quickly or a circulatory failure results and he falls suddenly and heavily like a lifeless chunk of meat.

(2) *Disturbances of attention.*—These usually occur with or only shortly after the disturbances of muscular coordination are first apparent, and are not as readily detectable as the latter. The most prominent characteristics of the form of attentional deterioration exhibited under low oxygen is the progressive restriction of the range of objects which can be regarded at one time or in close succession.

This might be considered more as a steadily growing attention heaviness and slowness than anything else. As though the subject were halfway between a waking and sleeping state, attention is more and more slow and heavy, and with marked effort shifted from one stimulus to another. If external conditions permit the subject to concentrate his effort on a single task to the neglect of the rest of his environment, an actual improvement in performance may result and continue until a very advanced stage of deprivation has been reached. That such improvement is really due to impairment rather than an improvement of attention is readily shown by making the task complex so that the subject must adjust himself to several concurrent series of environmental changes. Diminution of the number of such series to which the subject can attend indicates the extent of the impairment of attention. Near the limit of endurance the subject's attention may fail so that he can be aroused only by intense and unusual stimuli, and by them for a short time only. There is seen here a gradual narrowing of the threshold of attention with a concurrent gradual lessening of the light until finally only one stimulus has sufficient force to get over the threshold and then it is only perceived in a dim, hazy sort of fashion. This may continue to complete blackness, "lights out," and unconsciousness.

(3) *Deterioration of sensory processes.*—So far no evidence has been obtained which tends to indicate that these disturbances occur independently of those of attention. However, it is known that there is dulling of the action of the sensorium along with the lessening of attention. In some special tests of fluctuation of visual acuity under conditions which involve a high degree of maintenance of accommodation and balance of the extrinsic muscles, an interesting effect was demonstrated, that is, that the latter factors are apparently well maintained but all visual impressions become intermittent as the subject's limit is approached. The result is an apparent darkening of the visual field such as might occur if the optical pathway were interrupted by a rapidly rotating disc. This effect is ordinarily accompanied by blurring of the outlines of objects. Shortly afterward profound impairment of attention usually occurs and the subject's report on the adjustments of his instrument becomes indeterminate.

b. Voluntary coordination and controlled attention.—Undoubtedly the most important psychological effect of oxygen want is on voluntary coordination and on consciously directed and controlled attention. Until the stage of asphyxiation is reached in which the integrative mechanism rapidly approaches unconsciousness, there

are no effects which are not attributable to the failure of one or both of these factors. Until the subject approaches the limit of his endurance, experiments have shown no failure of perception, although the power of attending to stimuli may be lessened, discriminative judgment per se is unimpaired in rapidity and accuracy except as there is a failure of motor control and attention. Memory, both true and immediate, is unaffected except that because of greatly lessened attention many stimuli will not have sufficient force to produce engrams, and for these stimuli there will be a more or less patchy memory interspersed with islands of forgetfulness. As the test progresses there is a marked ease of distraction of attention until finally attention is dissipated and none is left for the task at hand.

140. Oxygen deficiency test.—*a. Results noted.*—As instances of tests involving perception and discrimination, copying of a list of words and the translation of words into code are cited. In both of these cases speed and accuracy are maintained up to the final stages of asphyxiation, provided the muscular mechanisms of accommodation and convergence are not seriously affected, although the mechanism for handwriting may be so affected that the written results of the list are legible with difficulty.

In more complicated discrimination where rapid and accurate classification of material is required the results are similar. Ability to remember and to chart correctly the relative spatial position of objects remains normal within the limits of ability to make adequate movements of the hand in charting.

It is interesting to note that the sensitivity and acuity of the sense organs show no consistent impairment and that apparently the speed of simple reactions (the simple reactions do not in general require a high degree of integration) is not intrinsically reduced. The distinctive effect on the nervous system in short seems to be a change in its integrative action and not a change in the irritability or the efficiency of any particular part of the unit. In this respect the whole picture of asphyxiation from a psychological point of view is strongly suggestive of progressive alcoholic intoxication.

b. Requirements.—Obviously since it is known that the chief effect of oxygen deficiency psychologically is on attention and voluntary coordination, some special test is required to determine the failure of these functions and the amount of that failure. It is important that the tests should be single and brief for if there is a large number of candidates it is not practicable to spend a great deal of time on each one. This eliminates many tests which might be valuable such as reaction time to different stimuli, but which require a large number

to be truly indicative. The test must be accurate as well as brief, for it is sometimes impossible to repeat it. Fatigue must enter the test as little as possible, otherwise fatigue effects might be confused with the effects of oxygen deficiency. Practice effects also must be eliminated as far as possible, otherwise individual differences in rate of learning would prevent the determination of the reactors to oxygen deficiency.

The test is essentially a deterioration effect rate test showing the effects of oxygen deficiency, and therefore each individual must establish his own standard of normalcy. Though there are certain fixed standards to which the individual must attain to be placed in one of the various classifications, the subject's rating is determined by himself as a standard for himself. For instance, one subject may show certain characteristics during the normal first few minutes of the run which because normal to him will be disregarded throughout the whole of the run; but in another subject the development of these characteristics during the course of the run would be counted against him. Though no two individuals show precisely the same reactions under stress there is an elastic zone, and those whose standards of performance fall within this zone are normal for the acceptable fulfillment of certain expectant duties. That is, dependent upon their performance standards men will be classified as to their abilities to be efficient in the performance of certain duties at varying altitude or conditions of oxygen deficiency.

c. Effect.—Voluntary coordination and attention are first and most seriously affected, because in the development of the nervous system these association paths are among the last to be medullated and to be myelin-sheathed. In other words, they are centers of higher functions, latterly developed and perfected, and here as in all mental and emotional deterioration, the higher centers are the first affected, leaving the primates for the last.

d. Subject reaction.—It was discovered during experiments that it was possible for a subject to pull himself together for a brief space of time, a minute or for several minutes, during which time his performance was as good or better than his normal. Therefore it is necessary that the subject be provided with a continuous task for if there be a series of tasks with brief intervals of rest between, the subject can accomplish a task that is nearly normal up to a moment before the complete failure of integration occurs, and his psychological deterioration may be masked. These periods of spurt are called attention peaks.

In addition to these limitations, the subject's reactions are further restricted by the fact that verbal replies are impossible, his head movements are greatly limited, his vision is correspondingly restricted, and as blood pressure is taken on the left arm throughout the run, this further limits the subject's means of expression to one arm and both feet.

The standard test differs from the usual psychological test in that a record of performance is kept minute by minute since the subject's condition is constantly changing, and in this way the observer can tell the exact psychological condition of the reactor at any time during the run. Speed and accuracy of reactions which are of such importance in the usual tests are important here only as they are an indication of the reactor's normal responses, and of the way that these normal responses are affected by oxygen deficiency.

- e. Advantages.*—The advantages of this particular test are that—
- (1) It is single and brief.
 - (2) It is accurate. A record of the subject's performance is obtainable at any minute.
 - (3) Practice and fatigue effects are eliminated.
 - (4) Continuous task eliminates attention peaks.
 - (5) Method of checking is quick. The final result is obtained within a few minutes after completion of the test.

SECTION XX

SELECTION OF TRAINEE FOR MILITARY AVIATION

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141. General.—*a.* The specialty, Aviation Medicine, was an outgrowth of the World War. Up to the time and even after the beginning of the World War effort had been directed solely toward developing the mechanical efficiency of the airplane. Little though, if any, had been given to the man who was to be responsible for flying the machine.

b. Through evolutionary development man had become habituated to a terrestrial existence. With the advent of modern aviation, he is suddenly projected into a new environment where he is subjected to rapidly changing conditions calling for quick physiological adjustments and decisions. Piloting makes tremendous demands upon physical factors which he had used little in adjusting to former conditions. The speeds traveled are terrific, and he has to compensate for diminished oxygen, lessened barometric pressure, intense cold, violent winds, and to marked disturbances of equilibrium, conditions which are intensely fatiguing not only from a physical standpoint but from a mental and nervous standpoint as well. He is suddenly projected into this strange and new environment thereby being deprived of the factor of time which is of such tremendous value in conditioning and preparing the human body to meet new conditions of life.

142. World War.—*a. General.*—During the early part of the World War the Allies selected their pilots in a haphazard manner. Frequently they were assigned to the Air Corps because of their inability to continue performance of ground duties. After many terrible accidents with their tremendous toll of manpower and material, the Allies began to consider the problems connected with flying and to wonder if all individuals were adequately endowed to meet these problems. In the beginning, courage was considered the only trait essential to piloting an airplane. If an individual possessed that to a high degree, there was nothing to prevent him from flying. Bitter experience taught the folly of any such assumption. No more do all individuals possess the aptitude for military flying than do all individuals possess the aptitude for painting, sculpturing, music, par golf, or any of the other accomplishments to which a favored few may attain.

b. *British.*—The British during the first year of the World War found that of every 100 aviators killed, 2 met death at the hands of the enemy, 8 because of defective planes, and 90 were killed as a result of their own individual deficiencies. Of these 90, 60 deaths were found to have been directly due to physical defects. Recent accident studies show that a high percentage of accidents are due to pilot errors. This startling state of affairs resulted in having the Medical Department called in to make a study of these problems. A special "Care of the Flyer Service" was instituted. Medical officers were assigned to duties with the piloting personnel. They were required to fly with them; to live in close contact with them, and to share their joys and hardships. The duties of this service were

to study the problems connected with flying and their effect upon the human body. Laboratories were established at the large training fields by all the countries. The medical problems considered by these investigating boards fall broadly into two functions, selection of the flyer and care and maintenance of the flyer.

c. United States.—It is worthy to note that when the United States went into the World War many investigators made the identical statement: "It is fortunate that the United States is realizing at the beginning the need of medical men in aviation." The early experience of the Allies was of great aid in formulating air training programs.

The first Research Board of the Air Service was established October 18, 1917, at Mineola, New York. As early as 1911 recommendation was made to the Surgeon General relative to special physical requirements for officers contemplating going into the aviation section of the Signal Corps. In 1912 regulations called for a special physical standard for pilots. This early standard, while extremely low, was the foundation upon which this country has been building since. From that time on the improvement in selection of trainees has been constant and the standard gradually raised.

In the fall of 1917, 67 trained examining units were established in the larger cities. These units examined thousands and thousands of young men for the Air Corps. Many medical problems connected with aviation were solved through the efforts of these pioneer investigators. This early work has been continued in turn by the Medical Research Laboratory, the School for Flight Surgeons, and at the present time by the School of Aviation Medicine, Randolph Field, Texas, and the Physiological Research Laboratory at Wright Field, Dayton, Ohio. An immense amount of research has been accomplished by the personnel of these institutions and as a result of their work, plus experience gained by medical officers' flying, there is ability to state which man should fly and which man should not, and also to predict with some degree of accuracy which student has the ability to learn to fly, and which one has not.

143. Factors.—The efforts of most investigators today are directed toward means of identifying and measuring those factors responsible for success in flying training and the adoption of selective methods to exclude applicants found deficient in these qualities. Early in the World War the training schools soon realized that a sound body did not necessarily mean success in flying training. This fact has been brought forcibly to the attention of those in charge of training by every class since that time. Of the thousands of young

men who rushed into aviation during the emergency, only a limited number were endowed to meet the rigorous demands of this hazardous vocation. Under the training system then in vogue the unfortunate misfits who were not qualified for this new vocation quickly eliminated themselves, resulting in useless and unnecessary loss of life and destruction of government property.

a. Aptitude.—It has been found that of every 100 men without physical defects only about 40 are able to meet the standards of proficiency set by the flying department. Potential ability for a given vocation is not easy to recognize and evaluate. Statements embodying prediction of achievement or lack of achievement for an individual in a vocation prior to an actual trial at the job is extremely hazardous. Aviation is no exception. Aptitude for piloting, or inherent flying ability, is an abstract term which does not lend itself to exact analysis. However, it is generally acceptable that this aptitude involves many specific as well as general abilities even though quantitative values cannot at present be assigned to them. Flying is an art, and aptitude or ability for the art of flying may be compared to aptitude or ability in any of the other arts. Musical aptitude is generally recognized and accepted as such but it would be difficult to define or to identify with exactitude what specific abilities are responsible for musical accomplishment. Inability at the present time to identify and catalogue with exactitude all the abilities involved in learning to fly an airplane should not prevent trying to develop examination methods to measure those functions which appear to be largely or partly responsible for success.

The flying schools of the services from their very beginning have been and continue to be much disturbed by the scholastic mortality of the trainees. Why the percentage of graduates was and continues to be small as well as the discovery of ways to increase the percentage of graduates has been a major problem of those in charge of training. These problems have been attacked from different angles by investigators. The training department has directed its efforts toward improvement in training methods. Flight surgeons are especially interested in ways of making a better selection of trainees.

b. Physical standard.—Early in the World War the rigorous demands of service flying was recognized. Endurance and stamina were considered essential, and as a result physical standards were high and with increasing knowledge these standards have become progressively higher. The gradual raising of the physical standards has not resulted in a corresponding increase in the percentage of grad-

uates among trainees in the flying schools. This would indicate that future progress must look to other methods and factors. Physical fitness is important but efforts directed solely to that factor leave out of account many other important ones.

Throughout the United States there are some several thousand young men between the ages of 20 and 26 examined annually for flying cadet training. These young men are from the various colleges and universities. Of those examined, about 80 percent fail to pass the physical examination. This is an extremely high percentage of rejection when considering that the educational requirement (2 years of college) has already served to prevent a large percentage of young men from even appearing for the examination. The 20 percent who pass the physical examination represent an extremely highly selected group. They are the cream of the country when measured by these standards.

c. System.—The ideal system of selection, and the one for which striving, is that which would enable the examiners to separate the applicants for flying training into two groups, those endowed with the potential aptitude or ability to meet the training standards and those who are deficient in these traits. This has been the goal for which medical investigators have been striving since the opening of the first flying schools. By this system, the many unfortunate misfits could be prevented from embarking upon this hazardous occupation for which they are unsuited and where accident liability is greatly increased as a result of their inaptitude. Much research and work has been done, many systems tried, all of which have been of value and have contributed to whatever progress has been made.

The scholastic mortality among flying trainees has shown some decrease over a period of years, but it is still far greater than is desired or what reasonably might be expected. The percentage of eliminations varies with the different classes. It has been as high as 87 percent in one class and as low as 44 percent in another. The average over a 20-year period is between 60 and 65 percent.

144. Failure students.—The expense of training a military pilot is not known. Estimates vary greatly. The average number of hours of flying instruction for flying cadet students who fail is about 25 hours per student. The average length of time of active duty for each failure student is about 60 days, that is, it requires about 2 months for the training department to determine that flying cadet is unable to make satisfactory progress in flying training and return him to civilian life. These failure students are a considerable factor in the operating expense of the training school.

In a period of emergency such as existed in 1917 where the time factor is of such great importance, the present system of selection will slow up the training programs tremendously. These inapt students are slow in absorbing instruction and set the pace or rate of advancement for the entire class. These failure students are not only expensive liabilities from a monetary standpoint, but in time of war the expense would be of small importance compared to the loss from the service of badly needed personnel caused by slowing down the flow of graduate pilots by choking the training schools with unpromising students. These failure students are a liability themselves, and in addition exclude other more promising students from training.

The practice of accepting applicants who are not qualified for military aviation is not only poor business for the Army, but most unfair to the individual. These unpromising students are being exposed to useless and unnecessary hazards with failure inevitable. The hazard of trying to learn to fly is much greater for students deficient in flying aptitude than it is for others. In failure, the student is probably experiencing for the first time the humiliation of defeat. His reaction to failure may or may not be favorable.

In accepting an appointment for training, the trainee gives up whatever vocation he may have been following. Frequently this is a college career. He may drop out of school just before graduation in the middle of a semester, or at any other time. With others it is a trade or a good position which is relinquished. In case of failure in flying training, the chance of the student resuming his former career at the point where he left off is extremely remote.

145. Graduate students.—There has been some gain in the percentage of graduates from the military flying school in the past few years. The factors chiefly responsible for this gain have been a better system of training, improvement in selection, and raising educational requirements from 4 years of high school to 2 years of college work. The advantage of the higher education has been adequately demonstrated. Recently there has been a tremendous dropping off in both the number and quality of applicants for flying training. It is believed and hoped this condition will be only of a temporary nature.

146. Research.—During the World War aviation authorities soon recognized that all young men were not suited for service in the Air Corps. Scientists were called into the services to study the problem of discovering special aptitude for flying (see secs. XVII and XVIII).

Medical research workers in this country profited greatly from the pioneer work done in Europe. Tests similar to those used in France, England, and Italy were employed in all laboratories. In addition many new tests were developed such as perception of gradual tilt; steadiness as measured by a marker attached on the head recording on a smoked drum; ability at judgment of curves; observation report tests, and complex reaction time. While this early work was recognized it never did receive its proper value. The time was too limited to establish the validity and reliability of these tests. These medical investigators tried to determine validity and reliability against a criterion or standard of proficiency of trained piloting personnel furnished by the commanding officer or other high ranking air officers. Ratings of these kinds are notoriously unfair as well as inaccurate. In many cases they are colored by prejudice, whim, and frequently based on factors other than flying ability and strictly official duties. In the absence of a satisfactory objective criterion of proficiency, the index of correlation between the test scores and these ratings was of necessity low indicating a little relationship between the two. The use of trained pilots in establishing standards on the tests is open to question. As a result of their training and experience they have become nonrepresentative of the type of person for whom the tests have been devised. Thus the value of this early work was largely lost because there was no reliable index of proficiency.

147. Relation with vocational selection.—The most important trend of industry today is in the effort toward the proper placing of workers. The right man in the right place is an age old ideal and is one to which employment agents are now devoting a tremendous amount of thought and study. Vocational selection is just beginning to receive attention commensurate with its importance. Primary schools, colleges, and universities recognize that individuals are not equally endowed, and that potential aptitude for special lines of work vary from individual to individual. It is also generally accepted that different occupations make different demands upon workers.

The demands of military aviation are not of the same order as those of every day occupations such as street cleaning, typing, salesmanship, etc. In the same way human capacity or aptitude is found to differ from individual to individual. This difference is fixed and is not eradicated by training. Industry has long since recognized the wastage of placing little men in big jobs; the loss of placing big men in little jobs is no less real. There is an economic

demand for a scientific system of classifying applicants and employees. If classified early, individuals might be prevented from entering vocations for which they are unsuited.

Before deciding to apply the principles of vocational selection to prospective trainees in the Air Corps, it should be known in detail the nature and cause of these individual differences. It is common to refer to a good performer or a poor one, the implication being that a big gap separates abilities in human beings. Abilities are not distributed in any such manner. In general the difference among human beings is found to be in quantity rather than in quality. It is rather a question of dosage. Each individual is endowed with certain degrees of capacity or possibilities of development along particular lines. The potentiality of achievement depends upon the strength of the various abilities or to the combination of traits producing favorable blends.

Each applicant for flying training will be found to possess all the traits that are necessary in learning to pilot an airplane, but these individual traits may not be present in amounts large enough to enable the applicant to make a successful military pilot, or there may be a qualitative combination or blend detrimental to the work in question. Unsuccessful pilots will be found to be no different from the successful ones in the traits possessed; the differences arise from the amounts or combinations of these separate traits. The piloting efficiency of the superior pilot is not due to any unique "faculty" or mental twist not the common property of all human beings.

148. Requirements.—*a. Aptitude and ability standards.*—If a scientific selection of trainees for the Air Corps is to be made, the flight surgeon must first construct a piloting ability pattern based on measured human abilities. What piloting an airplane means in terms of human aptitudes and abilities must be known. In addition this means the identification of those various traits by numerical and objective descriptions. A standard must be established in the form of a graph or profile showing the range and pattern of abilities necessary for success. Minimum and maximum amounts of these various traits must be known. After this standardized ability pattern has been worked out, techniques must be developed for the accurate determination of the amounts of these traits present in each applicant. Nothing would be more futile than to go in quest of some unusual trait, faculty or what not which the superior aviator is supposed to have and another has not. Quantitative values must

be obtained and the methods are hereby made more rigorous than if merely looking for the presence of a unique trait.

The task of estimating the efficiency of an individual is not easy; this is equally true of the pilot, and the machine worker. Before selection methods can be utilized to pick men who will be successful in a given job, it becomes necessary first to determine what constitutes success. Upon what abilities success depends and what the minimum amount is which an applicant must have in order to qualify for the job in question is basic information, and unless it is at hand and scientifically accurate, selection will remain largely a matter of chance.

b. Achievement factors.—The three factors which must be considered in arriving at what constitutes achievement in a worker are training cost, years of usefulness which may be expected in return for cost of training, and present skill or efficiency.

(1) *Training cost.*—Training cost is given great consideration in the Air Corps. While there are no exact figures as to the cost of training a flyer, it is probably very high. A considerable item of this expense results from efforts to train students who fail.

(2) *Years of usefulness.*—The second, years of usefulness, is given considerable weight in the military service. Every effort is made to reject those individuals whose stamina is low and for various reasons might not be expected to wear well and give long years of useful service.

(3) *Present skill.*—The third, present skill, is given most weight in the Air Corps and is the most difficult to estimate. In trades this factor may be easily measured in terms such as output per unit of time, time lost, accident record, and upkeep of machines, etc. None of these items mentioned serve as a satisfactory measure of the skill or efficiency of the Army pilot.

c. Success criterion.—Fortunately in selection for the Air Corps there is an excellent criterion of success at hand, not having to rely on the judgment of officers about the skill of trained pilots for the criterion. Accepted as a criterion of success is that capacity which is necessary to enable the student to meet the standards of proficiency set by the flying training department. Regardless of what other outstanding traits and abilities the student may possess if he is unable to meet the standards of the training department, he is a failure and it would have been to the best interest of all concerned had he not been accepted for training. It is assumed, and it is believed correctly so, that all students who fail in flying training do so because of some deficiency in those factors essential to success in military aviation.

This failure on the part of certain students to make satisfactory progress in flying training is not due to faulty training nor to lack of time. An increase in the percentage of graduates with the present system of selection of trainees can be made only by lowering training standards. It is believed this would be against the best interests of the service and the public as well. The old saying "a half a man or a poor man is better than no man at all" may apply with great force in many undertakings of life. It is doubtful if this is applicable to the Air Corps. A poor military pilot is probably worse than no pilot at all.

An accurate standard of flying proficiency or a composite picture of a successful pilot, if this were possible, would simplify greatly the job of selecting trainees. As yet no such standardization has been developed or determined. Efforts at standardization have been attempted through aeronautical ratings as made by commanding officers, etc. These ratings are in most instances based upon intangibles often having little if any relationship to piloting an airplane. After a very critical study of Army ratings, they were found to be accurate only within one-fifth.

149. Method efficiency.—How efficient are the present methods of selection? About 80 percent of those examined are rejected. These rejections are for various physical and mental deficiencies. The 20 percent accepted for training represent a very highly picked group. They are the best produced by the country when measured by present standard. It is logical to expect much in the way of achievement from this highly selected group, but such is not the case.

Earlier educational systems working with unselected groups of students expected the lower or poorer 25 percent to have difficulty in keeping up with the class work. Under this system the 25 percent who were superior and the 50 percent who were average were able to do the work and progress in a satisfactory manner. This resulted in a graduating percentage of about 75 percent.

The present trend of educational institutions, especially those of higher learning, is toward the exclusion or segregation of the inferior students. Colleges and universities are giving more and more thought to the problem of selecting their students. Most or all of the larger colleges use some type of aptitude test, plus high school grades as a basis for admission. According to the report of the Association of American Medical Colleges, 82 percent of the admissions to the freshman classes of 1935-1936 were subjected to an aptitude test. Medical schools are still greatly alarmed over the high percentage of academic mortality. This rate at present averages about 20 percent.

The authorities assume where there is an unlimited number of medical students from which to choose, as at present, with better methods of selection this academic mortality can be greatly reduced. Columbia University, as a result of entrance requirements (aptitude tests) is having an elimination of less than 2 percent on poor scholarship exclusively, that is, inability to accomplish the work.

There were 221 students enrolled for flying training in March, 1927, 29 graduating and 192 failing, or 13 percent success against 87 percent failure. The achievement record of the Army flying school expressed in percentage of graduates is not very gratifying. If it were possible to figure the cost of trainees who fail and prorate this expense among the graduates, it would be found that a large percentage of the training expense results from efforts to train students who fail.

The results indicate that present standards as well as the methods of application are highly efficient in selection from a physical, mental, moral, and educational standpoint. Rarely are students being eliminated as a result of a physical disability, moral delinquency, or deficiency in academic work. All failures, with extremely rare exceptions, are catalogued under the phrase, "failure to make satisfactory progress in flying training." About 60 out of every 100 cadets accepted for training in the Army flying schools are being eliminated because they do not possess to a sufficient degree those abilities upon which aeronautical achievement depends. To the War Department this means the useless expense of trying to train 60 out of every 100 cadets accepted for training. If converted into actual money, it would represent a large amount expended on failure students for each 40 finished pilots obtained. To the cadets this means that 60 out of every 100 accepted for training are being wrongfully separated from a vocation in which success may or may not be possible, and being placed in an occupation beset with hazards for which they are unqualified and failure inevitable. To the flight surgeon this means that he overestimates the capacities for aviation of 60 out of every 100 cadets accepted for flying training. Flight surgeons must be impressed firmly with the financial implication involved. Every flying cadet who fails to finish training represents an actual loss to the Government.

Inability to make satisfactory progress in flying training has been found to be the direct cause of student failure. This presents to the flight surgeon a specific problem, that is, selection of trainees who can and will meet the requirements of the training department.

The factors enabling one student to make satisfactory progress and another student not to make satisfactory progress in flying training is something possessed by both students, but in different degrees. It is a question of quantity rather than quality. The first step in the attack of this problem is the identification of the traits responsible for making satisfactory progress in flying training; next, the accurate determination of the minimum or maximum amounts of these a student must have in order to be able to make satisfactory progress in flying training; next, to measure accurately these traits in applicants; and last the rejection of those applicants whose capacities are below that essential to success. This is the method used by colleges and some industries and is the one which for years effort has been made to develop in the Air Corps.

Flight surgeons have been handicapped because of their inability to identify with any degree of accuracy the traits responsible for success in flying training. In addition, medical investigators were never able to establish a criterion of success. The information about native flying ability given by the training department has been in terms of such intangible qualities as to block all efforts at usable measures. Inherent flying ability has been defined frequently as "that innate faculty of selective and instinctive discrimination of the sensori-motor apparatus to adjust harmoniously metabolic changes in the physiological and psychological equilibrium in such a manner as to comprehend and assimilate instruction in the attributes necessary to perform the intricate complex operations which comprise piloting aircraft." In the absence of complete and exact knowledge about the traits responsible for success in flying training and without a specific criterion of success other than that of graduation, the investigator has only one recourse if research and progress are to be continued. He may assume that certain abilities are responsible for success and develop selection methods to estimate and measure when possible what seems to be the more fundamental of these abilities involved in the act of learning to fly.

The question has been raised frequently as to who is best qualified to undertake the problem of selecting trainees for the Air Corps. It has been the duty and responsibility of the Medical Department to select personnel for the service. While medical officers do not claim to have a monopoly on abilities of this kind, it is believed that as a result of their more uniform training as well as the similarity of this work to their routine duties, that doctors are in a better position to undertake work of this kind than any other officers in the service.

150. Flight surgeons.—*a. Definitions.*—As a result of aviation, a new specialty has developed in medicine which has become known as aviation medicine. In this country a specialist in aviation medicine is called a flight surgeon.

b. Duties.—(1) *General.*—The duties of a flight surgeon are examination of applicants for flying training, selection of those physically and mentally qualified, and supervision of the pilot in order to keep him in a fit condition to fly. From research and actual experience in the air, it is known that the aviator must have certain definite physical and mental capacities. Hard and fast rules have therefore been laid down with reference to the selection of the flyer. From the time the aviator leaves the ground until he returns thereto, he is in an entirely new and unnatural environment. His machine must be constantly watched and always subject to his will. This calls for agile exercise of his intellect, unfailing will power, a high degree of reflex and kinesthetic development, perfect coordination, and above all, complete control and guidance of his emotions. He must be on the alert every instant. He needs literally to see on all sides at once. In landing he must judge his distance very accurately from buildings, trees, other ships, and the ground. He must have a keen sense of motion as his equilibrium is constantly disturbed. He must be able to judge speed and to detect the minutest loss in sustentation. His vision must constantly shift from far to near, and near to far in order to read his instruments, watch other planes, etc., and his reactions both mental and physical must be quick and accurate. He is subjected to unusual fatigue, especially of the nervous type.

Flying is not only a hazardous occupation, but one in which the pilot is called upon to meet stresses and strains hitherto foreign to him. The records in Great Britain for the year 1926 show that 37 percent of those eliminated as unfit for the Air Corps was due to some form of nervous trouble. The Germans found that during the World War the largest number of aviators who had become unfit for service had to be relieved for some nervous complaints. Excepting nervous exhaustion or nervous unfitness, not a single disease was more frequent among the aviators than among the other branches of the service. The question of stability of the mental, nervous, and emotional type is an important one, and one which must be considered carefully in attempting to estimate flying aptitude, neither underrating the task nor overrating the individual's nervous resistance. Everyone has a breaking point but individuals vary in this as in all other traits. In selecting flying personnel only those must be selected who are much above the average in emotional, nervous, and mental control.

In consideration of an individual's reactions to flying, especially under wartime conditions, it is necessary to remember that it is dealing with a defense mechanism developed to combat the fundamental instinct of self-preservation, that is, a conflict exists between the most dominating fundamental instinct with another which stands much lower in the scale. The adjustments the individual will make and the permanency of these adjustments will depend primarily upon the organization and integration of the personality.

(2) *Method.*—It is by the application of the principles of vocational selection that the maximum efficiency in the selection of trainees for military aviation can be reached.

(a) First, a very thorough physical examination to eliminate those who do not rate high in physical endowment.

(b) Second, a very complete and painstaking neuropsychiatric examination to eliminate all the mental and nervous weaklings including temperamental and personality handicapped individuals such as eccentrics, disturbers, irritable, unsocial, peculiar, gossipy, arrogant, and other mental twists types, all unsuited to aviation.

(c) Third, psychological tests, both subjective and objective, rating or actually measuring when possible those traits or abilities which appear to be involved in learning to fly a military airplane, that is, classifying trainees in terms of native flying ability.

It is by the combination of these methods that the applicant's potentialities can best be determined, and from the standpoint of approach and evaluation they loom highest in the armamentarium of the up-to-date flight surgeon.

CHAPTER 2

PERSONALITY STUDY

SECTION I

PERSONALITY AND INDIVIDUAL DIFFERENCES

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151. Nature of personality.—*a. General.*—(1) Of the many problems concerned in the explanation and understanding of human behavior, probably none is of greater general interest than the mystery of personality. At the same time there are few terms that are subjected to more abuse than personality. With advances in the dissemination of news and with increased speeds of travel, the possibilities to react to and observe the reactions of others have increased tremendously. With advancing knowledge of human behavior and encouragement of adult education, more and more people are trying to understand the behavior of those about them as manifestations of this or that type of personality. Passing judgments on others has been a common pastime for ages. One is pleasing, strong, weak, capable, or vicious. One has “personality plus.” One has a “poor” or a “good” personality. All these are evaluations of personality, the judger usually having little idea of just what he is judging or upon what criteria he is basing his estimations. Fads and fakirs capitalize on the fact that personality has in the past generally implied something mysterious and glamorous. Stylists will create a “hair-do” and perfumers will blend a special mixture to match a woman’s personality.

(2) Researchers, including doctors, psychologists, and physiologists, have investigated many varied objective and subjective tests

to evaluate and measure personality without complete agreement as to just what they were investigating. Besides these, employment agencies, job analysts, employers for big industries, and others are thinking, discussing, and writing in terms of personalities. Much of this more serious work is of great value and some of these views on personality will be examined and present and discuss the one which seems most comprehensive according to the present views will be presented and discussed.

b. Definition.—Personality at best is intangible, and the term has been and will no doubt continue to be used in different senses. One definition by a psychiatrist, A. J. Rosanoff, used the term personality “to designate the inborn psychic capacities, traits, and tendencies of the individuals.” Another view with psychiatric needs in mind and given by Dr. Amsden defined personality as “the aggregate of those tendencies predisposing to reactions which the individual has come habitually to display in the adjustments his life has required of him.” The first definition by limiting personality to inborn qualities neglects the frequently powerful influences of environment in shaping, conditioning, and altering one’s reactions. Both definitions also fail to stress the unity and individualness of personality, by calling personality the aggregate, or the sum total of various unrelated traits, tendencies, etc. Nevertheless they are both good definitions and probably for certain uses are adequate and intelligible. The definition given below has been presented by a psychologist, Gordon Allport, and the full import will only be gathered by following through the discussion which follows. It should be appreciated that while personality is closely tied up with an individual’s behavior because behavior is the manifestation of personality, behavior itself is not personality. Personality is much less tangible than observable behavior reactions.

As defined by Allport, “Personality is the dynamic organization within the individual of those psychophysical systems that determine his unique adjustments to his environment.” Calling personality an *organization within the individual* gives it a mark of unity and stresses the personal identity which exists between the individual and his personality. To call it an organization implies a completeness or unity made up of component parts or lesser units each of which contributes to the whole. Organization further implies interaction and interdependence between the parts as well as possibilities for alterations in the organization, for increasing complexity of the organization, and for disorganization.

This organization which is the personality is said to be *dynamic*, for it is true that personality is not static, but definitely an evolving, changing thing. Dynamic also indicates the motivational aspect of this organization meaning that the urges, drives, and desires, both in kind and degree, are dependent upon this organization within the individual.

c. Psychophysical system.—One of the basic principles resulting from psychological and psychobiological studies today is that mind and body are not separate. There is no evidence that thoughts or ideas exist independent of a physical basis, and their existence is dependent on physiological activity within the body. What is called "the mind" influences and is influenced by bodily reactions to a greater degree than is usually recognized. *Psychophysical systems* refer to this dual aspect of personality and remind that this organization is not exclusively either mental or physical. As an example of a psychophysical system, a thought, or a perception, or a group of ideas may be of enough significance to an individual that physiological reactions result in various parts of the body. Many and perhaps most of these psychophysical systems are developed through conditioning experiences during the early part of life, and will be different for each individual. Other psychophysical systems may be inherent and fairly uniform throughout a species as manifested by "instinctual activity." The psychic or mental aspect of such a system may be the perception of some danger which threatens life. The physical response consists of all the physiological manifestations of intense fear, and these psychic and physical aspects together are the psychophysical system. Many of the psychophysical systems are conditioned during life and frequently are altered due to new conditionings and thereby make the total organization which is the personality different from what it previously was. In some instances very important psychophysical systems do not characteristically appear until many years after birth. Sex thoughts, desires, and accompanying physical activities have to await mental and physical maturing before that system is completely evolved. All these relationships between the mental and the physical are the psychophysical systems. Their nature, variety, degree, number, complexity, combination, and organization all add to make up an individual's personality.

d. Adjustment reactions.—(1) These psychophysical systems *determine* adjustment reactions of the individual. This again points out the motivational aspect of the personality. It stresses the fact that activity is concerned, but it must be remembered that it is not this

behavior which is the personality but the organization which lies behind the activity. The organization is of systems, each of which predisposes to reactions which the individual characteristically displays, and it is by the habitual adjustments and expressive acts that one's personality comes to be known.

(2) No two individuals go through life with identical experiential histories. Because conditioning experiences differ ever so slightly adjustment activities of each individual differ from those of all others. The adjustments of an individual then are *unique* adjustments. Even adjustive acts based on inherent hereditary factors are manifest by a wide range as to degree and variety in different individuals. Now read again, this definition of personality in the light of this elaboration and explanation: "Personality is the dynamic organization within the individual of those psychophysical systems that determine his unique adjustments to his environment."

152. Behavior and personality.—*a.* Although some investigators see personality as behavior itself (defining personality as meaning the characteristic ways of response that serve to differentiate one human being from another), the view presented herein identifies personality with the organization of patterns, dispositions, and tendencies which lie behind the reactions themselves. According to the definition of Allport personality is intimately and intricately related to behavior. Through behavior one's urges, feelings, impulses, and other reaction tendencies are manifest. Behavior is the observable manifestation of the organization within which is the personality. It is by observing behavior, whether motor acts, overt acts of intelligence, emotional response, habits, or other observable conduct, that personalities may be studied. It is through behavior that self is expressed, and it is only through this medium that others can know the personality.

b. Obviously this does not tell the whole story, for all of one's personality is seldom manifest by outward behavior. Modern civilization with its development of inhibition and self-control teaches to mask or suppress much that is "going on inside." There is no doubt that one's personality as he knows it may differ considerably from his personality as seen by others through observable reactions. To understand fully a personality one should have knowledge of both objective and subjective nature. Unfortunately this is often impossible to obtain, and even when obtainable the subjective reports are often unreliable. Too many individuals seem unable to know what really is "going on inside." They take a self-deceptive view of themselves, rationalize their behavior, and are unable to "see

themselves as others see them." In such individuals the observable aspect is a much more reliable index to their personality than their own reports.

153. Personality changes.—*a.* Reaction tendencies change, likes and dislikes come and go, and completely new impulses and dispositions appear during the course of development. Added experience and knowledge alter entirely outlooks on life and purposes for living. While there is possibility that modifications may be brought about at any time during an individual's life, undoubtedly the greatest changes and modifications take place during the early developing years. It is during these formative years especially that environmental factors and training play their part in shaping personality. Later when patterns and tendencies have repeatedly been exercised they become more definitely a part of the personality, and are less subject to alteration. With maturing and strengthening of habits and dispositions come a stabilization and definiteness to the personality. Also, the sense of unity and of personal identity between the individual and his reaction tendencies is increased.

b. It is said by some that complete development of personality is not achieved until the individual finds the greater part of his impulses and reaction tendencies striving toward some one purpose. A greater integration of the inner organization (personality) becomes evident. His urges and dispositions are closely knit into a unity manifested by behavior habitually directed toward one dominant interest. The individual perhaps identifies himself with some great cause (relief of suffering, world peace, etc.). Such a maturing of personality is closely related to development of a philosophy of life which only comes after many experiences and influencing factors have played their part in forming the individual. Even though such habits become the most characteristic thing about an individual, there are many other less integrated and less firmly fixed dispositions resulting from accumulating knowledge and new experiences. These are constantly changing and permit fluctuations and further evolution of the personality.

154. Individual differences.—*a.* Whenever an examination of any species of complex organisms is undertaken, it becomes at once apparent that each organism is unique, that it is an individual unto itself, and that it differs in many respects from all others of its own species. This observation is readily appreciated as one observes his fellow human beings, as he compares one to another and to himself. Individuals manifest differences in every aspect that has ever been brought under consideration in which attempts to measure or esti-

mate have been made. Thus in individuals of the same age there are wide variations in such physical features as weight and height, structure and size of bones and muscles, color of skin and eyes, texture and distribution of hair, and countless other variations of a physical nature. Capacities and functions of these structures also show wide variations as in differences of visual acuity, speed and strength of muscular reactions when used in running or skilled movements, vital capacities of the respiratory system, modifiability and conductivity of the nervous system, and capacities of various glands as to storage and activity. While less easily measured or estimated, there are many other traits which individuals possess and which vary just as widely from one to another as the above physical features. Among these are abilities as in mechanics, art, music, mathematics, woodworking, and other acquired skills. Still less definite are such features as immunity to disease, responses to motivating influences and tolerance to thwartings, intelligence and ability to learn, general emotionality and permanent moods, and potential levels of drive and initiative. All these differ in degree from one individual to another; in fact, there is no trait of mind or body which does not show these individual variations.

b. All the traits just mentioned which show these individual differences are possessed to some degree by all members of the human species. Thus every individual has to some degree height and weight, intelligence, emotionality, motives, instincts, and capacities along the same lines as all other human beings. Differences between individuals depend upon differences in amount or degree to which these traits are present in each individual. In other words, it is a quantitative rather than a qualitative difference which accounts for these variations.

155. Distribution curve.—*a.* In considering any particular trait or feature which may be taken for investigation among a group of individuals, it will be found that the variations cover a wide range. At one end will be the individual showing the least of the measured trait and at the other end will be the individual showing the most. Between will be large numbers showing intermediate amounts of the measured trait. A large number of measurements will show that the range from least to most is a continuous one with all amounts between represented, though not in equal numbers. Thus it will be found that the greatest number of individuals will cluster around the middle range, while those levels representing lesser or greater amounts are represented by fewer and fewer individuals. This is demonstrated readily by the range of heights of a group of 208 Army officers who

appeared for a recent physical examination (see fig. 3). It is apparent even on such a small group that the complete range from the least to the greatest measurement is represented. It is further seen that the greatest concentration is toward the central measurements. In this group 167 of the 208 are between 67 inches and 72 inches, inclusive. This will be the typical finding if measurements of any trait or feature should be similarly plotted. It will be found that the greatest number of individuals are grouped around the center or average while toward either end is a thinning out and the number of individuals giving these extreme measurements become fewer and fewer.

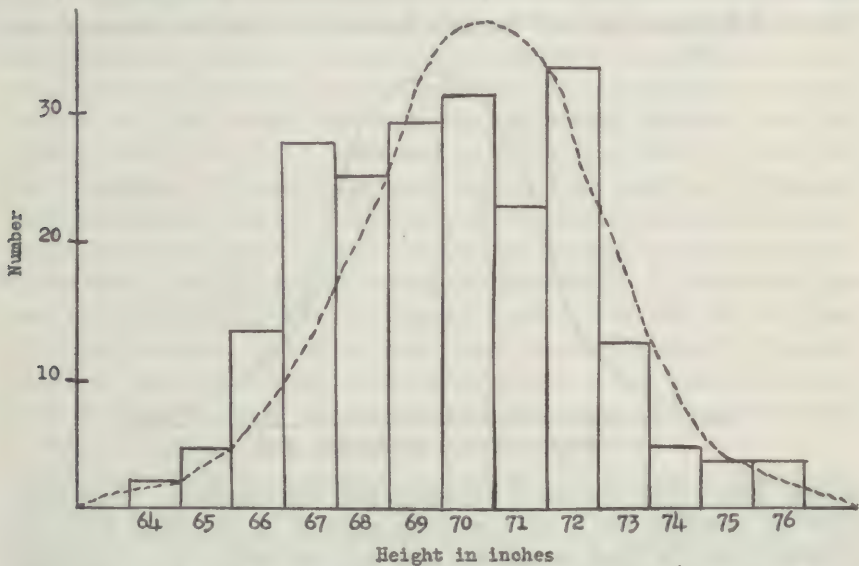


FIGURE 3.—Distribution of heights of 208 Army officers.

b. When a great many persons are used as in computing statistical findings on physical measurements by insurance companies, the curve resulting approaches a smooth curve known as the normal distribution curve, or as the normal probability surface (see fig. 4). In plotting a small number of observations or when there has been an artificial, modified, or biased selection of individuals due to other influences, the plotted curve may vary somewhat from the normal curve. Thus in the curve for height of Army officers in the above small group, there is a shift of the center or average toward a height greater than that of the normal probability curve for heights of men of this age where the average would be at about $68\frac{1}{2}$ inches.

156. **Members of group.**—*a. General.*—(1) Individual differences between members of a group are apparent from the earliest possible opportunity to observe them which is usually at the time of their birth. While at that time the differences observable and measurable may be practically limited to physical appearances and anatomical structures it can be recognized that no two are identical. Later in life when the intellectual, affective, and volitional features have added their coloring to the personality, the differences between the same individuals will be even more noticeable, and to place the responsibility for these original and later differences has been the basis of much speculation and investigation. The question is an old one and is not answered to the satisfaction of everyone. Individual differences are attributable broadly to the two opposed but

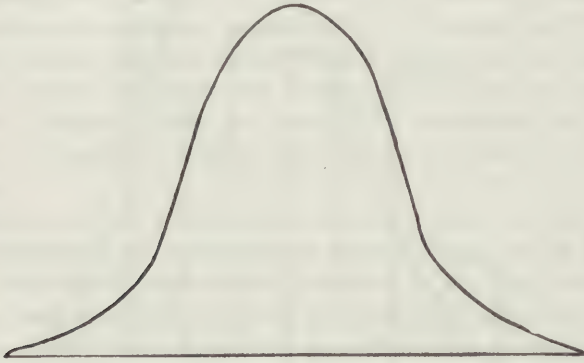


FIGURE 4.—Normal distribution curve.

closely interwoven forces of heredity and environment. The influences of heredity are those that were present in the child from the moment that he was conceived and can be called innate factors. Under this category are the intrinsic factors such as sex, race, and immediate ancestry. The influences of environment are due to factors external to the individual in contrast to the innate nature of hereditary factors. These include educational, cultural, social, physical (including accidents and disease), and other agencies which mold and shape an individual from the time of his birth until his death.

(2) Generally speaking, there is a greater range of variation in those traits which have been acquired most recently in the evolutionary development of a species than in those which are simpler and more fundamental from a biologic standpoint. Perhaps that is why there has been such great interest and why the most intensive

and extensive work has been done in the investigations of mental variation, these higher mental traits being among the latest acquired in the evolutionary scale and presenting such wide variations. Thus the feeble-minded differ hardly at all from the normal in physical development and motor capacities, but differ widely in learning, in association, in language, and in ability to use abstract thought as in dealing with mental images and ideas. However, normals as well as feeble-minded differ widely among themselves in these same processes with the central or average being the most commonly met status, and the markedly inferior or superior being relatively and equally infrequent.

b. Men and women.—Several comparative studies of males and females have failed to indicate any great differences which might be attributed to sex alone. The differences between men themselves and the differences between women themselves are far greater than any between the two sexes. Some of the differences between men and women which have been presented as a variation between sexes are the following. Women have been reported as superior in tests of memory and in foreign languages, better in color discrimination, better in school work, more interested in people, more patient and sympathetic, but less stable emotionally than men. It is claimed that men are superior in tests of logical construction and in problems involving abstract relations, they have a greater speed of motor response (reaction time), are more interested in athletic ability, have a superior sense of humor, and are more independent than females. Many of these questions are still open ones.

c. Races.—Careful comparative studies with primitive races indicate that those people did not differ greatly from modern individuals in general sensory equipment such as visual and auditory acuity, and sensitivity to touch and pain stimuli. Also, simple intelligence tests of the form board type (a board with variously shaped holes cut out into which blocks of different shapes are to be fitted) reveal no great differences between whites, Eskimos, and American Indians. Some pygmy tribes however do no better than imbecile or very low grade whites. Several investigations have shown the negro to be more overtly emotional and less inhibited in his reactions than the white. Intelligence tests given to large groups of whites and negroes in the American Army place the negro below the white. The American Indian also ranks consistently below the white man on tests of mental capacity. In all these comparative studies, however, it is difficult to say how much of the difference is due to native as against cultural factors.

d. Family.—The influence of immediate ancestry can be studied best by comparing siblings with their parents and with each other. It has been demonstrated that twins are more alike from physical and mental standpoints than brothers and sisters who are not twins. Sister and brother, sister and mother, brother and father are more alike than are two unrelated individuals. Very probably many of the mental resemblances noted between members of the same family such as common ideas, attitudes, peculiarities of thought or speech are due to common influences in the environment and from association with each other. However, it is generally agreed among investigators that besides all this there is an appreciable and important influence by native factors.

157. Study of man.—The study by scientific methods of man as a living, growing, and social organism has been of such recent development that the results already secured have hardly become recognized, established, and appreciated generally. It is true that prior to 1900 such studies were discouraged because of lack of methods, confusion of such problems with the philosophical and mystical, and by religious taboos against such studies being applied to living man. However, since the changing trends which came with the new century an immense amount of investigation has been applied to the human being with the result that a tremendous amount of material has been accumulated. Just how much or how little this mass of information will eventually influence man to change his surroundings and possibly bring about changes in the characteristics of the individual himself remains to be seen.

SECTION II

HEREDITY AND ENVIRONMENT

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158. Heredity.—*a. General.*—(1) Because it is believed that the facts of heredity account for a considerable amount of the variations found between individuals, a brief discussion of heredity as it is understood today is presented. While some investigators put a great deal of stress on heredity as a determinant for the ultimate outcome

of an individual and others belittle heredity and say that all is due to conditioning environmental factors, a combined view or middle road seems to be more logical.

(2) The facts of inheritance have been recognized since the days of the cave man. The son was recognized as the child of his father because he resembled the father in form, feature, and mental traits. These are facts of biologic inheritance and while recognized as due to having sprung from the father's flesh and blood, full and adequate explanations have not yet been discovered for all workings of heredity. Much is still at the level of theory and should be recognized as such in the following discussion.

b. Definition.—Just what is meant by the term "heredity?" Lacking complete knowledge makes an exact and concise definition very difficult. The following, while not considered an adequate definition, states what is concerned when one discusses heredity. Certain conditions or patterns of organization are maintained through a succession of individuals by the process of reproduction, and as a result of this organization, particular characteristics appear under the right conditions. Heredity then involves a form of organization, and a succession of individuals resulting from a process of reproduction. Under the right conditions certain characteristics will develop in succeeding individuals because of continuation of the same organization pattern.

159. Theories of heredity.—*a.* Early thought on the subject of heredity was mainly speculative, and has left little mark on modern theories. On the other hand, certain principles which still hold true have been recognized for a long time by breeders of animals. One of these clearly recognized long ago was the fact that when two widely divergent varieties were crossed, the offspring tended to resemble the wild form of the species. This principle known as atavism still holds true and is a consequence of the fact that most variants are recessive to the wild type.

b. Various theories were put forward during the nineteenth century based on the assumption that acquired characteristics were inherited. However, late in that century others showed that characteristics acquired by the adult are not in general transmitted to the offspring. It is generally held now that acquired characteristics are not so transmitted.

c. Francis Galton, a cousin of Darwin, had much to do with the early investigations along these lines and through his efforts attempts were made to better the human race through intelligent and well-directed breeding. From the mass of statistical data which he ac-

quired he deduced his "law of ancestral inheritance." This stated that to the total heritage of the offspring the parents on an average contribute one-half, the grand parents one-fourth, and the great-grandparents one-eighth, etc., the total heritage being taken as unity. This law is now recognized as only a foreshadowing of the truth, and his formula should be looked upon as an occasional possible consequence of the actual laws of heredity and not as one of those laws in itself.

160. Mendel's laws.—*a.* Shortly after the middle of the nineteenth century Gregor Mendel carried out experiments in the hope of discovering some regularity and means of predicting the facts of heredity. His original paper on "Experiments in Plant Hybridization" was published in 1865, but was forgotten until the turn of the new century when three independent workers rediscovered Mendel's treatise and confirmed his conclusions. Because his original work was so carefully carried out and so thoroughly and clearly presented, practically nothing has been altered in Mendel's Laws and they carry his name.

b. Mendel conceived an organism as being a complex of a great many "unit characters" which could be independently inherited and variously combined in the offspring even of the same two parents. He imagined a mechanism in the germ cells consisting of some definite factor for each character upon which the development of each character depended. In order to obtain a clear result, he saw that it would be necessary to select some character and study it separately through a great many generations, making careful observations on the selected character in the different generations. The edible pea was chosen for Mendel's subject because varieties in cultivation are easily distinguished by striking characteristics which are easily recognized. Further, these plants are habitually self-fertilized, a feature which obviated numerous difficulties.

c. (1) An example which illustrates the methods and findings as simply as any was the study of heredity in respect to height. Mendel took a pair of varieties of peas of which one was tall, being 6 to 7 feet high, and the other was a dwarf variety, 9 inches to 1½ feet high. These two were then crossed together. The seeds produced by this cross breeding grew into plants which were always tall, being of a height not noticeably different from the pure tall variety. Modern terminology calls such a crossbred first filial generation, or F1. Because the character tallness appeared in the crossbred to the exclusion of the opposite character, Mendel called it a "dominant" character; dwarfness which disappeared in the F1 plants he called "recessive."

(2) The tall crossbred F1 by self-fertilization produced seed which when grown made the second generation, or F2. These proved to be mixed, many being tall but with some short ones too, this generation having plants that resembled both the tall and the short grandparents. Upon counting the tall and the short varieties of the F2 generation it was discovered that the proportion of tall to short showed a certain constancy, averaging about three tall to one short, or about 75 percent dominants to 25 percent recessives. His findings are shown below:

Parents:	Tall (TT)	Short (tt)
F1:	All tall Tt Tt	Tt Tt
F2:	75 percent Tall (TT) Tall (TT) Tall (tT) Tall (tt) Short 25 percent Short	

d. From these experiments Mendel showed that when certain contrasted characters are brought together in a hybrid F1, the two original characters appear in the next generation, or F2, in definite proportions, and further that the appearance of this character can be predicted numerically in succeeding generations. He assumed that these determining units are sorted out in the germ cells of each generation in such a way that each germ cell (ova or sperm) carries one or the other of these units. Chance fertilization of any ova by any sperm accounts for the numerical ratios found in the next generation. The only special functions attributed to these units were their power to reproduce themselves and for each to retain in successive generations its specificity as to the character which it determines.

161. Chromosome theory.—Mendel applied the term “determining unit” to the determinant for the appearance in the resulting organism. The more modern term for this elementary unit is “gene,” and by the chromosome theory is meant the view that locates the genes in the chromosomes. Chromosomes are small, rod-like bodies of nuclear material which are visible in the process of cell division under the microscope. Chromosomes occur in pairs, the number of chromosomes being constant for all members of a given species, and varying in number from species to species. In the human being there are 24 pairs or 48 chromosomes. According to this hypothesis, the characteristics of the individual are represented by genes in the chromosomes and this accounts for and permits formulation of definite laws of heredity.

162. Segregation.—The essential discovery which Mendel made and which accounts for the regularity perceptible in the hereditary transmission of differences is the fact of segregation. To understand this phenomenon will require following through a few facts of cell

c. In the formation of germ cells the case is a little different. Here the chromosomes do not divide before cell division and each egg cell and each sperm receives only half of the number of chromosomes as were present in the parent cell. Since chromosomes are arranged in pairs, one from each pair goes to each of the resulting germ cells. In the human being which characteristically has 24 pairs of 48 chromosomes, there is a reduction in the formation of ova and sperm so that each of these cells contains only half the number characteristic of the species, or 24 chromosomes.

d. The reduced number of chromosomes in each egg cell and in each sperm represents one chromosome from each pair of the original cell, but they are sorted in a random order and because of this an almost infinite number of possible combinations is possible, especially

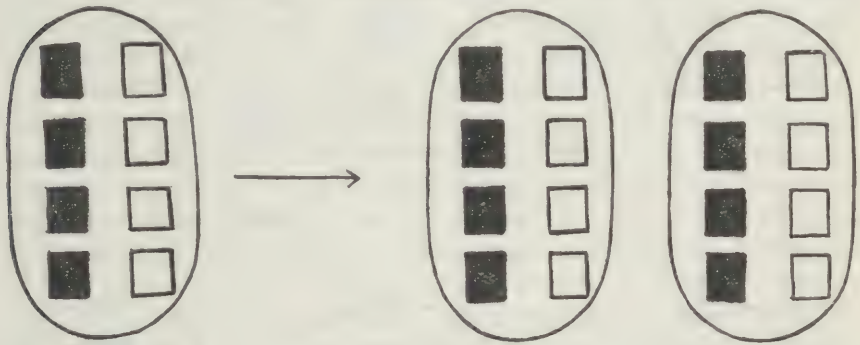


FIGURE 6.—Simple cell division.

in species which have as many as 24 pairs of chromosomes. Probably no two ova or sperm of a given individual receive exactly the same assortment.

e. When a sperm and an ova unite to create a new individual the nuclei fuse, and there is again the full number of chromosomes characteristic of the species, half of which have been contributed by each of the germ cells. See figure 7. The original cell shows the full complement of chromosomes of the species, and assume in the figure that the row of open chromosomes was contributed by the male ancestor (sperm) and the solid chromosomes by the female ancestor (ovum). Just before division in which reduction is going to take in the pairs of the chromosomes so that the distribution of any chromosome to one or the other resulting germ cell depends entirely on chance. One chromosome from each pair goes to each of the new germ cells. The two ova and two sperm shown in figure 7 show only

some of the possible results of this segregation. With 24 pairs of chromosomes the possibilities are infinite. The sorting occurs in accordance with the laws of chance and this is the principal basis of segregation and accounts for the fact that there is predictable regu-

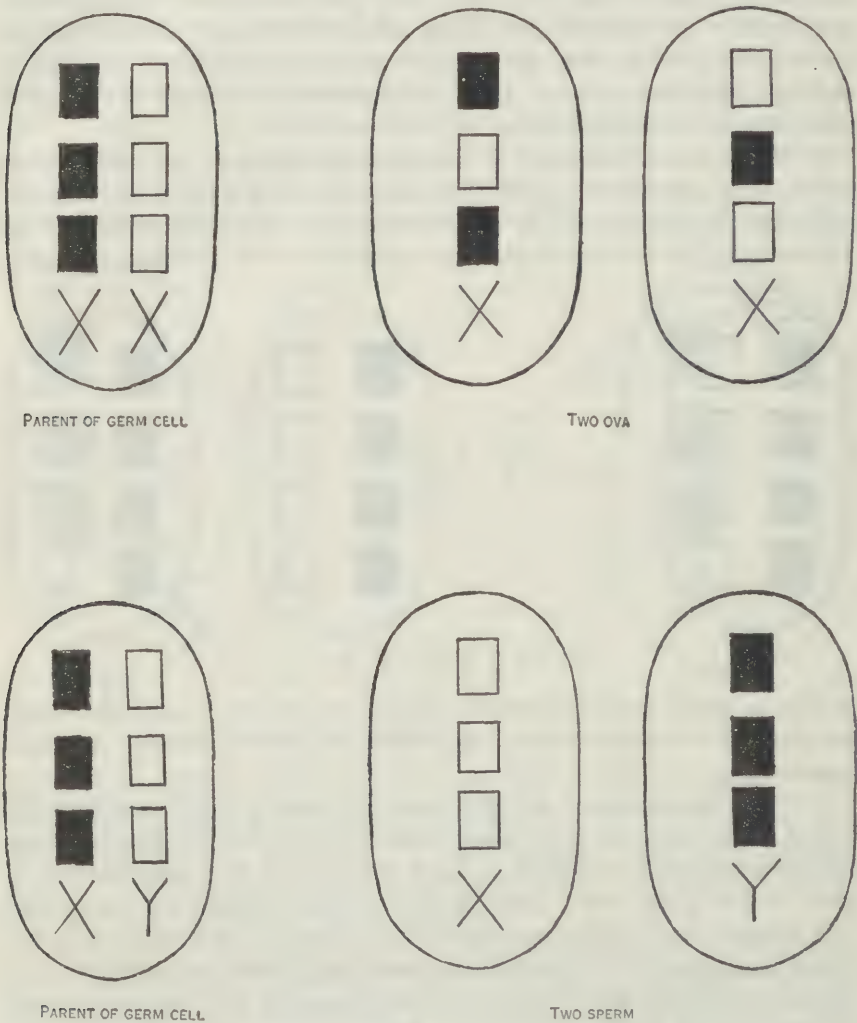


FIGURE 7.—Reduction and segregation.

larity in the appearance of inherited characters. By various combinations of the two ova and the two sperm shown in the figure, two female and two male offspring could be created each of which would have chromosome complements different from that of the others.

f. While the explanation of segregation is to be found in the behavior of the chromosomes, it should be remembered that the actual determinants are genes which according to the chromosome theory are located within the chromosomes. Probably each chromosome contains many, perhaps even hundreds of genes, each having its own specific and distinct determining power. The majority of the genes contributed by one parent are no doubt like those from the other, making all members of one species similar in form, structure, and general behavior. However, in most mating there are some gene differences which permits various combinations through segregation and which accounts for the variations in form, feature, and behavior between individuals.

163. Mutation.—Variations in individuals then can be accounted for in many instances by segregation, and in fact most of the variations are due to this cause. However, there is another source of variation which is known as mutation, a term which is now used to refer to the appearance of an entirely new gene in the germ cell. When mutations occur they apparently do so in a single individual in a completely random manner, and suddenly. Somewhere in some chromosome an entirely new gene appears which may produce from very slight to marked effects on the individual. For instance, in the case of the fruit fly, *Drosophila*, in which many mutations have been observed, such things as change in wing length, number of legs, or color of the eyes may be affected. Mutations are presented by some as forming the basis of the evolution of species and as accounting for all genuinely new characteristics which appear in individuals. Some mutations are beneficial but some may be harmful. Harmful mutations may place a species at such a disadvantage that they will not long survive. Mutations occur very rarely, but even so when one considers the millions of years in the life of a species, it is possible to see how extensive changes may be brought about.

164. Heredity in man.—*a.* There is no doubt that the laws of heredity are the same in man as in animals and plants, but as yet control over these factors is very different in the human being from that applied to lower animal forms. Certain types of animals are bred from extensively because of certain characteristics. Although eugenics make studies of various agencies which may improve the qualities of future generations, including such things as favorable mating and the prevention of unfavorable mating, wide acceptance and application does not at present exist. Also, the determinants of many of the characteristics of man are not to be explained as simply as the above discussion might suggest. Probably many genes or par-

ticular combinations of genes are at work in determining many of the complex types of human behavior.

b. A number of conditions appear in the human being which are definitely of a hereditary nature. Dominant abnormalities which are handed down to about one-half of the affected parent's children include myopia, certain types of presenile cataract, retinitis pigmentosa, night blindness, certain malformations as brachydactyly, lobster claw, and others. Another group of hereditary conditions are the sex-linked recessives which are limited to one sex, and most of which seem to affect the males. Color blindness and haemophilia are important examples of this type. From an affected male they are passed through an unaffected daughter to her sons.

c. Psychological characteristics are not nearly so easy to understand or explain. For one thing, it is difficult to measure psychological characteristics as emotionality, intelligence, volition, power of concentration, etc. While children often resemble each other or one or the other parent in mental characteristics so markedly that hereditary factors seem obvious, the processes concerned are probably very complex. Identical twins furnish one important line of evidence for the existence of hereditary conditioning. They resemble one another far more than brothers and sisters who are not twins, or twins who are not identical. Some studies made on identical twins who were separated at birth show that their adult intelligence quotients are similar but that they may differ greatly in their emotional reactions and in their moral and ethical characteristics.

d. Mental defectives frequently show many abnormal individuals among their ancestors and such conditions appear to be strongly inherited, although probably not according to a definite Mendelian course. Fortunately many of these defective states seem to be recessive, but in the case of feeble-mindedness it is difficult to make any definite decisions because the lines between normal, dull, and feeble-minded are not clearly drawn. Probably many genes are concerned in such a complex quality as intelligence.

165. Environment.—*a. General.*—While the hereditary factors just discussed are of great importance in development of any individual and exert their influence from the time a child is conceived, one must not lose sight of the fact that many of the differences found between individuals are to be attributed in part to environmental influences also. In fact there is a never-ending interaction between these two factors for the extent to which hereditary factors can determine individual differences is frequently magnified by environment, and the extent to which environment can modify original differences is limited

by innate capacities. Environmental factors include every influence that is brought to bear upon the human being from time of beginning his life and include surroundings, nourishment, disease germs, accidents of birth and physical accidents later, as well as all educational and experiential influences throughout life. Environmental factors are essentially external ones as compared to the hereditary ones which are innate. Modern civilization with its complex social and economic organization has created many diverse environmental situations which one cannot help but recognize as exerting powerful molding though perhaps contrasting influences on every individual. Thus side by side in one city live rich and poor, the former well able to furnish himself and family with every need even to the extent of luxury, while the latter may be unable to provide the barest necessities in the way of food, clothing, and shelter. One man may work in the blasting heat of furnaces while stoking in a boiler room, while another works comfortably in an air-conditioned office, and another travels the seas and is constantly exposed to changing conditions as determined by the elements.

b. Physical development.—In early developing years the physical development of an individual is to a definite degree dependent upon the environmental forces in which he grows. An insufficient and too restricted diet results in stunted growth and once the individual has reached maturity or nears that stage, his retarded development cannot be entirely overcome. If there has been an extreme lack of physical exercise, this may result in poorly developed muscles and poorly coordinated movements. Accidents resulting in loss of sight, loss of limb, or other disability may profoundly influence personality development.

c. Mental traits.—Man's physical development and status is not the only aspect influenced by environmental factors but his mental traits as well. Thus one man may possess refined tastes, good manners, and be well informed, whereas another may lack these features or present contrasting ones. Men acquire very different degrees and kinds of knowledge as well as very different habits and customs. These acquirements are largely dependent upon the social environment and are drawn from the habits, customs, and knowledge accumulated by the society in which the individual finds himself. So there is the physical environment consisting of those factors as food, light, climate, exercise, effects of disease, and accidents, and there is the social environment which largely determines what mental knowledge and mental habits the individual shall acquire and manifest.

d. Social heritage.—Certain of these environmental factors seem to exert such marked influences that a little further discussion of them is given. Perhaps of the greatest importance is that which has been referred to as the “social heritage” and which corresponds to what Trotter called the “herd instinct.” Social heritage includes race traditions of ethical, religious, and social nature which may be handed down from one generation to another, as well as the more immediate influences on the individual of attitudes of community or group of which the individual is a member. Many of the most fixed beliefs are merely the result of accepting suggestions of the community or teaching of the home without any critical reasoning on the matter at all. This factor has assumed great importance in determining the mental as well as many of the physical characteristics of individuals. Beliefs as to diet (faddists), fresh air (nudists), education, and political organization (monarchy, dictator, democracy, etc.), are all determined largely by the viewpoint of the nation, community, or family. Also more subtle and personal things as closeness of relationship between family members, tendency toward taking responsibility and early independence, moral and ethical ideals, and religious beliefs are determined by this factor. The nature of this social heritage it can be seen depends upon the social class in which an individual finds himself during the developing years, and teachings, beliefs, and tendencies will be found to differ widely in different parts of the world.

e. Climate.—Another environmental factor which unquestionably influences personality to a considerable degree is the climatic conditions. Analysis of this seems to indicate that various combinations of the two climatic factors temperature and moisture produce different effects. High temperature combined with moisture tends to depress certain vital activities and gives rise to an indolent, lazy type indisposed to any great exertion of any kind. Inhabitants of the Malay peninsula exemplify this type. High temperature associated with dryness leads to intermittent activity which, when it comes in spurts and starts, may be of a violent nature capable of great expenditure of energy. The dashing Arabs and the Sikhs of India illustrate the effect of dry heat. A cold, dry climate has a bracing, stimulating effect, permitting sustained activity but when combined with moisture seems to dispose to a somewhat slow but sustained continuous activity, giving the impression of sluggishness but at the same time great energy and perseverance. The Dutch and English show effects of the combination of cool climate and moisture. There is no doubt that climate does exert a great influence on individuals

and probably individuals differ as to the climate in which their mental and physical functions are at their best. Many have felt the effects of change of climate, the feeling of exhilaration upon reaching the mountain air with escape from the heat of the valley. Or, to one accustomed to a temperate climate, the moist tropics soon impresses a willingness to accept the slow tempo of activity and an unwillingness to exert any great effort.

f. Altitude and drugs.—Other environmental influences as altitude or drugs may produce definite effects on one's personality but these are more often of a temporary nature. The specific effects of anoxia and of drugs in producing or releasing personality manifestations are discussed in other sections, but in general they both seem to act in a similar manner by removing inhibitions and often uncovering a personality make-up not suspected as masked by convention and inhibition.

166. Relative weight.—While the relative weight to be given the influences of hereditary and environmental factors is not generally agreed upon, the view presented here holds that development and resulting status of the individual and of his various traits is due jointly to hereditary and environmental factors. The existing or final result is not due wholly to manifestations of native determinants, nor is it entirely the result of influences of extrinsic forces upon an impressionable passive mass. It is from the interaction of these two factors that the final product results. From hereditary factors, the general direction may be determined and certain limitations may be imposed, but during progressive stages of growth and development the environment does exert its influence and modifies to various degrees an individual's traits and character.

SECTION III

MANIFESTATIONS AND TYPES

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167. Manifestations.—In the innumerable attempts to classify man, many and various standards have been used. He has been classified as to physical type, race, color, religion, political belief, men-

tality, and in many other ways. Also many attempts have been made to classify man psychologically and according to this or that type of personality. Great difficulties arise here however for no matter how nearly a number of individuals may conform to group and environmental demands they are all individualistic to a certain extent. In some ways each is different from all of his fellows. However, as the result of intensive studies along these lines, it has become apparent that there are many types of behavior which are more or less common to all individuals. The term "traits" has frequently been applied to these behavior manifestations, and it is by the varying degrees to which a trait is exhibited, and by the various combinations of traits that the differences between individuals are recognized. One must remember that according to the definition (see par. 151) it is not the behavior itself that is the personality, but the inner organization which lies behind and determines what these traits and combinations of traits will be. To a great extent the differences between individuals are only quantitative, and most individuals will manifest these "common traits" to a greater or lesser degree. Most of these traits can be manifest over a scale from "high" to "low" (high intelligence—low intelligence) or over a range from two extremes which are opposite or contrasting (ascendancy—submission). Any individual can be placed somewhere on the scale of any and all of these common traits and it will be found that the distribution of large numbers will follow the normal distribution curve described in paragraph 155. While the following brief discussion of common traits is not complete, it covers a wide range of personality manifestations and stresses those to consider in rating flying adaptability, but does little more than enumerate a number which have been extensively discussed in chapter 1. Some of the others which have not been so discussed will be considered in detail in section IV.

a. Physique.—While the purely physical and anatomical structure of an individual may appear quite foreign to psychological traits and personality manifestations, the fact remains that the physical cannot be separated from the psychological. Physique is definitely a part of the psychophysical systems which make up personality, and there is no question that soundness of body, good health, and plenty of available energy determine to a considerable extent many of an individual's trends and capacities. Physique may be evaluated along the following scales: symmetry—deformity; good health—ill health; high vitality—low vitality.

b. Intelligence.—Intelligence has been discussed fully in section XIV, chapter 1, and the great importance of intelligence as a variable should be readily appreciated. While in the broadest sense intelligence refers to ability to solve new problems by applying results of past experience, there are numerous psychological operations which are intricately related as intellectual activities. These include such things as memory, learning, perceiving, reasoning, judgment, and tact. Intelligence may be measured and rated from high intelligence to low intelligence.

c. Emotional content.—A variable which is not easily measured but which nevertheless is of great importance is the emotional content. Two aspects of the emotional response are somewhat subject to evaluation, that is, the breadth of objects evoking emotional responses and the strength of emotions as habitually displayed. Emotional content then may be placed along the scales of broad-narrow, and of strong-weak.

d. Psychomotor activity has not been considered to any extent in the earlier divisions, but it refers to the activity levels both mental and physical at which an individual habitually functions. Some related aspects of this activity are output of energy, strength of drives, and control and effectiveness of efforts. Endurance may be graded from persistence to vacillation. Control or inhibition may be manifest along the scale from impulsion to deliberation. Habitual strength of general activity can be placed between intense to weak.

e. Self-seeking tendencies.—A large number of traits which are largely manifestations of attitudinal tendencies of an individual toward other human beings may be grouped under the heading of self-seeking tendencies. These include the variables self-assurance—self-distrust, aggression—submission, expansion—reclusion, and introversion—extroversion. An individual may be placed on any of these scales somewhere on the continuum which runs from one extreme to the other.

f. Sociality as a general heading probably is related closely to some of the variables mentioned under the previous heading. However, two aspects which are probably more definitely social in nature are the desire or lack of desire to be with people, and the urge to conform to ideals of society and to be adequately molded by its influence. The degree to which these tendencies may be manifest are to be scored along the scale of gregariousness—solitariness, and adequate socialization—inadequate socialization.

g. Self-analysis.—Individuals vary greatly in the degree and success with which they analyze themselves. This insight into one's own

capacities and limitations may be good if carried out by impartial observations and in an objective manner. There may be poor insight as when one estimates his own capabilities in a self-deceptive manner. Desirable to undesirable degrees of this ability are rated on the self-objectification—self-deception scale.

h. Nervous stability is a personality trait which implies ability to maintain continuity of consciousness and to avoid faintings, absences, and convulsions. *Nervous instability* implies the opposite, that is, a tendency to lose consciousness readily, to commit automatic acts, faintness, etc. Individuals manifest all degrees of this variable from marked stability to extreme instability.

i. The above list of traits as personality manifestations by no means covers all common trait variables. Among others which may be mentioned are such variables as masculinity—femininity, radicalism—conservatism, optimism—pessimism, and so forth.

168. Psychological profiles or psychographs.—Psychographs as the one shown in figure 8 permit one to tell at a glance to what degree each trait is manifest by a given individual. Such graphs are highly flexible and can be varied readily by including only those traits of interest to the investigator. Many of the traits mentioned above do not have adequate standardized methods by which to determine the degree to which they are present but the best available methods are discussed in section IV. However, all of them can be expected to follow the normal distribution curve so that the great majority of individuals will manifest the various common traits about the average or middle level. A glance at the psychograph will show in what traits an individual is highly endowed, average, or below average. The profile given touches only those traits which have been stressed above and is by no means complete or applicable to all investigations.

169. Abnormal types.—Perhaps the greatest amount of work on the subject of personality has been accomplished by psychiatrists and much can be learned by studying some of their views. Actually a large part of any psychiatric examination is a personality study of the patient made by the psychiatrist. Many of the symptom complexes and mental diseases dealt with by psychiatrists are based upon personality manifestations alone so that the psychiatrist especially must be quick to recognize deviations from the normal in personality manifestations and interpret such behavior properly. The following discussion of abnormal types of personality taken from "A Theory of Personality Based Mainly on Psychiatric Experience," by Dr. A. J. Rosanoff, presents the view that certain neuroses and psychoses develop

in particular personality types. He states the more clearly defined types to be antisocial, cyclothymic, autistic, and epileptic.

a. Antisocial.—Antisocial personality is the constitutional basis which underlies hysterical manifestations, malingering, pathological lying and swindling, and some criminal careers. The essence of it is

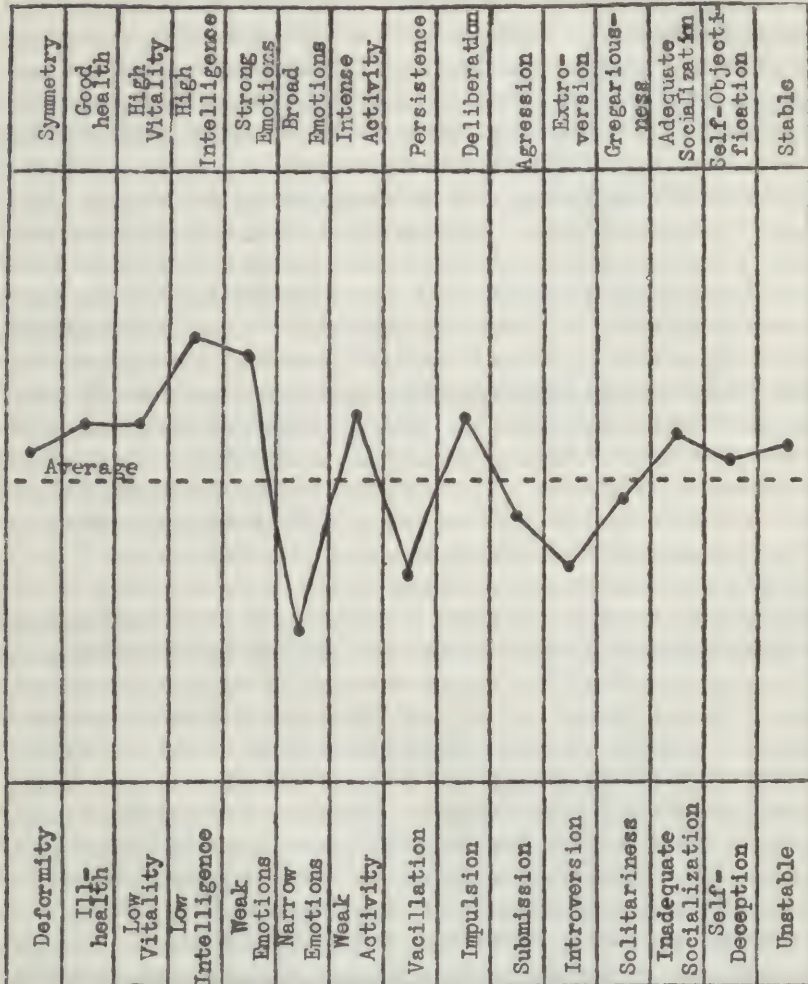


FIGURE 8.—Psychological profile or psychograph.

the predominance of illicit selfish motivations in behavior of the individual combined with more or less lack of compunction.

b. Cyclothymic.—Cyclothymic personality is the constitutional basis on which manic-depressive psychoses develop. One authority distinguishes four principal varieties, manic make-up, depressive make-up, irascible make-up, and emotional instability.

(1) *Manic make-up*.—Referring to the manic make-up, it has been stated: "They usually acquire scant education, with gaps and unevenness, are disinclined to effort, are distractible and seek to escape from constraint of a systematic mental culture in order to carry on rapidly changing secondary activities; their emotional tone is elated, carefree, self-confident; toward others they are overbearing, arbitrary, impatient, insolent, defiant. They are given to jests, self-ridicule, chatting; their moods of anxiety or sadness are transient; they are approachable, communicative, and readily adaptable, but quickly long for a change; their conversation is quick, animated, abundant; their writings are verbose, pompous, full of personal remarks and forced witticisms. Many join, with weakening zeal, newly appearing movements; others develop into mountebanks, professional buffoons, town characters. There is sometimes shown a planlessness of procedure, and often a conflict with environment. They mix into everything, but, displaying uselessness, generally fall into economic ruin. When their means are exhausted, they borrow, commit fraud and swindle. The mildest forms of this disturbance lead toward certain make-ups of personality which are in the domain of the normal. Here we deal with brilliant but unevenly endowed individuals with artistic inclinations. They delight us with their nimbleness of spirit, their versatility, their multiplicity of ideas, their alert open-mindedness and spirit of enterprise, their artistic ability, their kindheartedness, their gay, sunny disposition."

(2) *Depressive make-up*.—Concerning the depressive make-up, the following has been stated: "There exists a special sensitiveness to the cares, troubles, and disappointments of life. Every task stands out like a mountain; all activity is a burden which they usually bear with conscientious self-denial and without the compensation of the joy of living and creating. They readily become anxious and despondent; feel they are unfit, nervous, ill, fear an attack of some disease, especially mental or brain disease. They lack self-confidence, decision; they spend endless time in weighing and considering without accomplishing. They may entertain suicidal thoughts. They feel tired, complain of giddiness and unpleasant sensations in various parts of the body, oppressions, tremblings, twitching vibrations. The fundamental state of depression can be quite suddenly interrupted by manic attacks. Even more frequently occurs the alteration of manic-depressive attacks."

(3) *Irascible make-up*.—The irascible make-up has been described as follows: "These patients show from youth an extraordinarily fluctuating equilibrium and are strongly affected by all experiences. They are easily offended, hot-headed, and become enraged easily. There

follows violent scenes with scolding, yelling, and tendency to assaults. The emotional coloring is subject to various changes. Ordinarily they may be serene, self-assertive, ill-controlled, but periods intervene in which they are cross, sullen, dejected, anxious, cry without cause, and are hypochondriacal."

(4) *Emotional instability*.—Emotional instability is thus described: "It is seen in those persons who swing back and forth between the two opposite poles of emotion. Today lively, sparkling, radiant, full of joy of life, enterprise and action. They meet us after a while depressed, listless, dejected, feeling the need of rest, only to show again several months later the former liveliness and elasticity."

e. Autistic.—Autistic personality is the constitutional basis on which dementia praecox or schizophrenic psychoses develop. Perhaps the most fundamental trait of autistic personality is narrowing or reduction of external interests and contacts and preoccupation with inward ruminations. Concerning the type the following has been said: "They do not have a natural tendency to be open and to get in contact with the environment, are reticent, seclusive, not adaptable, hard to influence, often sensitive and stubborn. They show little interest, and often do not participate in the pleasures, cares, and pursuits of others; they do not burden their minds, are shy, and have a tendency to live in the world of fancies."

d. Epileptic.—(1) Epileptic personality has not been so sharply distinguished from so-called normal personalities. In practice there is no difficulty in identifying it when accompanied by the ordinary manifestations of epilepsy. It is possible to distinguish periodic alterations of mood and consciousness and, less clearly, permanent characteristics.

(2) Among the permanent psychic characteristics the following are more or less general: Strong, tenacious, unreasoning personal attachments, and less often, similar prejudices and dislikes; impulsiveness; religious fervor, tendency toward mysticism and with it sometimes credulousness and superstition; heightened feeling of self and craving for self-expression; striking tenacity of purpose with a lasting patience and meticulous attention to detail; inconsistencies of conduct intelligible enough to one who has an insight into epileptic personalities, but often misunderstood by the casual observer for insincerity or hypocrisy.

170. *So-called normal*.—The contrasts between abnormal and normal types of personality are only to a slight extent qualitative and for the most part quantitative.

a. Qualitative.—(1) Among the traits qualitatively distinguishing normal personality are inhibition, emotional control, a superior durability of mind, rational balance, and nervous stability.

(2) Although normal persons are not entirely free from selfish motivations and antisocial or destructive influences, they are distinguished by ability to inhibit them. They also possess a controlling mechanism whereby they are protected from excessive emotional manifestations which might interfere with steady and purposeful activity.

(3) Whereas epileptics and schizophrenics suffer a mental deterioration due to brain atrophy, the normal personality and cyclothymic personalities possess a great relative durability. Cyclothymic personalities are protected against pathological manifestations by the continuity of their external contacts, while it seems that normal personalities are protected by an influence which makes for rational balance and is perhaps akin to the inhibition and control securing other psychic functions against pathological excess.

(4) Nervous stability, or the power of maintaining uniformity and continuity of consciousness and avoiding fainting spells, convulsions, deliria, automatisms, absences, and other epileptic manifestations, is possessed not only by normal personalities, but also by antisocial, cyclothymic and to a somewhat lesser degree autistic.

b. Quantitative.—The quantitative contrasts between abnormal and normal types of personality do not show sharp lines of demarcation; mixed types are the rule, pure types the exception. Every qualitatively definable trait is subject to quantitative variation. Among so-called normal persons there may be antisocial tendencies, lability of moods, autistic thinking, and a tendency to become faint and lose consciousness or suffer convulsions under the influence of various physical and psychical causes.

c. Combination.—(1) Desirable varieties of personality consist of the fortunate combinations of traits. For various tasks and situations in life now one group of traits, now another, appears most advantageous. Even limited antisocial traits may have a biological value in that they underlie a good deal of prudence, diplomacy, success in commercial and political fields. The sensitiveness and power of expression of cyclothymic personality is shown in literary and historic art and in all pioneering activities. The ability peculiar to the autistic personality to exclude every diverting influence and extraneous interest provides great concentration of mental energy in science and in other fields. The inspirations, stubborn patience and determination as observed in epileptic personalities underlie much of all human achievement.

(2) Although the normal element of personality is important in psychic life, it may put its inhibitions too continuously in operation and lead to a hampering effect. Thus many normal persons have their mental visions rendered opaque by an instinctive and discriminating conservatism, are incapable of a flight of imagination, cannot overcome the inertia of standing still, oppose all change and progress, and resist every generous and courageous impulse.

171. Intelligence and sexuality as components.—*a. Intelligence.*—Any degree of intellectual capacity may coexist with either normal, antisocial, cyclothymic, autistic, or epileptic make-up, but the relative frequency of feeble-mindedness seems to increase with descent in the scale of dominance. The intellectual make-up of 906 cases of manic-depressive psychoses, 1,563 of dementia praecox, and 93 cases of epilepsy admitted to the New York State hospitals was tested. The proportions found to be of intellectually inferior make-up were for the manic-depressive cases 10 percent, for the dementia praecox 23 percent, and for epilepsy 43 percent.

b. Sexuality.—The role of sexuality in all relations of life is so overwhelming that any peculiarity in sexual make-up must effect a profound modification in personality. All kinds and degrees of variation of sexual make-up may occur in connection with each of the personality types. Clinical experience has shown that general eroticism, sadism, masochism, and fetishism have to be reckoned with in schizophrenia, and frigidity in hysteria. The almost general auto-erotism of schizophrenia and the indiscriminating promiscuity of feeble-mindedness are hardly to be considered as primary sexual anomalies, but rather as secondary to the fundamental personality defects and as their logical consequences. Some traits or manifestations of personality seem to be somewhat sex-linked. Thus criminality and alcohol and drug addictions are more prevalent in men than in women. Hysteria appears more frequently in women while in somewhat less marked contrasts manic-depressive psychoses prevail more often in women and dementia praecox in men. A striking instance of a trait showing this sex-linked inheritance is that of nomadism, and the impression is gained that this trait is in some correlation with various neuropathic manifestations such as psycho-neuroses, dementia praecox, epilepsy, feeble-mindedness. Perhaps the nomadic tendency exists as a component of normal as often as of neuropathic constitutions, but its release takes place more readily in the absence of the normal inhibiting influence.

172. Extrovert and Introvert.—*a.* One classification of mankind into psychological types seems to be so fundamental that it

warrants special consideration, the classification as extrovert or introvert. Upon considering man psychologically, it is found that he may be divided into two great groups neither of which is rigid and inelastic. There must be subdivisions in each group and they merge one into the other. A man may be predominately in one group and yet show characteristics of the opposed types. Indeed, this always is true because no one is entirely of a certain type showing none of the reactions of the opposite type. These two great groupings of mankind are caused by his reactions to the external world of tangible reality and by his reactions to the internal world of thought and affect which, although not demonstrable objectively, is just as real and tangible subjectively as the outer world is objectively. It may then be said that the two main groupings are caused by the proportion of subjectivity of the individuals to be classified. He falls into one or the other group, depending upon whether he is or is not a "mixer." The reason for this typing is not pertinent at all from the present point of view. The Freudians say he is so shaped by his environment that presently he is either predominantly subjective or objective. The disciples of Jung, who coined the terms *introvert* and *extrovert* contend that because of heredity, both individually and racially he is born predominantly subjectified or objectified.

b. Consider the two great groups into which all mankind falls, the introvert and the extrovert types. Extroversion is the thrusting out of the mind to the life in the outer world, the pouring out of the libido on external objects. To the extrovert all stimuli of value come from the outer world. Introversion is the turning in of the mind upon itself. It involves a withdrawal from the external world and the cultivation of an internal mental life. For the introvert all valuable stimuli come from within himself and are projected to the outer world of objectivity. The extrovert is the primitive biologic type, for biologically the mind and its powers are of value only as they can be of practical use in life. They are developed in a positive relation to the world in which the organism lives. Their nature is determined by the environment of the species to which they become intimately adapted. This is biologically true both mentally and physically. Those things which at first seemed strange and bizarre to him, become the usual and the ordinary. On the other hand, the process of introversion is primarily a sign of lack of adaptability to the outside world. For some reason or other the psychic energy of the mind, the libido, fails to find its material outlets. Because it has to go some place and because the external world is blocked off, it

turns in upon itself and develops an internal world of its own in which it largely dwells. As a sequel however this characteristic, this internal development, has proved of great value in enriching human life by its secondary reactions to the external world. To the extrovert the external world is the vital thing of which he is an important appendage; to the introvert he himself with the internal world of his own creation is the fact of import, the external world of reality being merely a background to be shaped or distorted as he pleases.

c. A satisfactory adjustment with the external world and the demands of the herd requires a certain balance between these two opposed types since any marked departure from this balance leads to the extreme types of personality known as the introvert or extrovert. These two extreme types are incompatible with the herd requirements and demands, and for their own safety and the best interests of the herd require segregation from the herd. This type of almost pure introvert is illustrated by the dementia praecox case which reverts to stupor and the prenatal attitude, thus escaping almost entirely from the external world of objective reality and living in a subjective world of phantasy. The almost pure type of extrovert is illustrated by the various manias of the manic-depressive psychoses who escape from the inner world of subjectivity and with almost incredible rapidity flit from one external stimulus to another.

d. The extrovert lives in and for the world. Practically all stimuli come to him from the external world and consequently all his interests are projected externally; all his thoughts and feelings are always at its service because to him all things of interest and value come from without. This innate personality characterizes the extrovert as the man who does things. He is most often an opportunist; his domestic life in all its details is of great interest to him, and he is often voluble and versatile. No extrovert shows entirely extroversion characteristics with no admixture of introversion and the same is true of introverts. The very extreme extroverts and introverts cannot react in adequate compatibility with the herd demands and therefore are placed in seclusion for the benefit of the majority. An excellent example of a man prominent in public life who was predominantly extroverted was former President Theodore Roosevelt. One of the main reasons for his great popularity was due to the extroversion characteristics of projecting the emotions outward to the outside world where the principal stimuli originate. Stimuli that affected others affected him; he felt with them and thus gained an emotional kinship with his fellows.

e. In contrast, the introvert is absorbed with his own mental processes. He excludes himself from the affects of the outside world;

for he retires within his own mental life and lives secluded into himself, being influenced only by his own affects colored as he conceives they should be. He usually has a fairly profound knowledge of himself, and because it is more satisfactory to live within himself his habit of intense mental concentration gives him great powers of penetration into any outside sphere to which he may successfully devote himself. Because of his ability of mental rumination, analysis and appraisal, he becomes capable of successfully and correctly evaluating phases and aspects of life which he has never seen and felt. However, unless he finds some measure of extroversion, the introvert's mental life may limit itself to a fantastic world of his own thoughts and feelings entirely divorced from the world of external reality. He cannot extrovert spontaneously, naturally, and unconsciously as does the natural extrovert, but can do so only as a matter of conscious determination of his own set purpose through the medium of his own ideas. His observation and introspection have taught him that he should stay in conventional adjustment with the outside world of reality. When he is successful with his extroversion mechanism, his intervention in the life and affairs of the herd is marked by a finer quality of keen logic and precision than that of the natural extrovert. Recognizing the substantiality of the outside world of reality, he forcibly projects to it, receives its stimuli, and selects as much as he wants. These stimuli are carefully and slowly appraised and analyzed, various modes of reaction are considered, and the appropriate reaction selected only after great deliberation. Where the natural extrovert quickly reacts to stimuli and apparently by instinct the introvert reacts to outside stimuli slowly and only after deliberation. The introvert is the planner who carefully and patiently evolves complicated schemes, formulæ and hypotheses, creates philosophical systems, metaphysics and abstruse abstract problems. The extrovert is the impulsive doer, the man who prides himself upon being practical, the man who must do things now, perhaps to be doing something entirely different tomorrow, versatile, energetic, realistic, often blundering but seldom hesitating, the man who madly rushes in where angels fear to tread, quick to anger and quick to relent and to become contrite when he sees the damage done. The introvert is the idealistic dreamer, the cold-blooded, calculating planner who weighs all possible contingencies. He is slow to act but stubborn, implacable, and immovable, the man who does for a principle. He is reserved and shrinks from intimate contact with his fellows; he hides his emotions. The extrovert is a hail-fellow well-met who is cheerfully and light-heartedly willing to lead a forlorn

hope and die just for the fun and zest of adventure. These two main types will be considered more in detail when their subdivisions are described. A good illustration of a man prominent in public life who was predominantly of the introversion type is the late President Wilson.

f. Because of the higher mental quality of the introvert, it is very often possible for him to appreciate reality more completely, to disregard calmly and dispassionately mere trifles and view reality as a panorama. He may by effort gain insight into reality, and thus more appropriately meet its demands after it has passed the barbaric stage than does the mental extrovert. After the adolescent period it is very difficult for the natural extrovert to develop an internal life that broadens and enriches the personality. Why should he read a book if it is of no practical value to him in his dealing with reality? It is only by training during the periods of childhood and adolescence that the best balance of the tendencies of the two types can be obtained. The basic personality types perhaps are inherited and can be recognized by observation of the child. The basic extrovert can be taught to weigh his stimuli, to plan and judge, to pause before action and then firmly to carry through the appropriate action in the face of all obstacles. The introvert can be persuaded and encouraged to come out of his shell, to mix and mingle with his fellows, to gain contacts with the outside world and to use his mental powers for practical ends.

173. Neurotic.—*a.* There is a vast ill-defined group of individuals who mingle with and are only distinguished from so-called normal individuals with difficulty. They constitute a great borderline group to the members of which the terms *unstable* or *neurotic* have been applied. While in many instances they do not present medical problems they are nevertheless maladjusted individuals who disturb, retard, or misdirect the social wheel. It is these individuals with neurotic personality make-up who in their unsuccessful attempts to meet life's situations develop psychoneuroses and come to physicians presenting the great variety of symptoms known as neurotic complaints. It is often thought that a neurotic is not trying and is making no effort to adjust, but as a rule this judgment is quite unjust. The neurotic does try very hard, but by such faulty means or along such wrong directions and at the same time with so little understanding that his achievements are almost negligible.

b. The fundamental characteristics of the neurotic person are an intense feeling of inferiority and insecurity. At the same time a considerable amount of introspection and attention by himself to his

own shortcomings lead to further feelings of self-depreciation and sense of unworthiness. Unconscious conflicts frequently result because of thwartings to success due to his real or imaginary deficiencies, and many of the neurotic symptoms are the results of these conflicts, expressions of the attempts to attain success and to adjust to the problems with which he is faced. In this connection one must not lose sight of the fact that the physical ailments of a neurotic cannot be put aside as nonexistent and imaginary. While a great majority of neurotic physical complaints are the manifestations and results of psychologic conflict, it must be remembered that the distorted primary instincts and emotions which characterize the neurotic can and do have their counterpart in physical disturbances. Attention to this aspect of psychosomatic medicine is claiming more and more attention.

c. Many neurotic persons behave normally when with strangers and in routine social activities but show the signs of their neurotic make-up when at home or with close friends and relatives. A great deal of the tendencies and reactions of neurotic persons are present in normal individuals though the neurotic usually manifests them to extreme or exaggerated degrees. It is only in the extreme forms as in fully developed psychoneuroses that many of these behavior patterns can be considered at all pathological.

d. One characteristic type of behavior reaction which is manifest by practically all neurotic persons is a greatly increased suggestibility. This is to be expected, for suggestibility is directly related to feelings of inferiority and self-abasement. By suggestibility is meant the readiness to accept propositions with a conviction not justified by logical reasoning or adequate grounds for its acceptance. Aggressive, independent individuals have little suggestibility in their make-up. They are more likely to give suggestions than to take them. On the other hand, self-abasing, dependent individuals with deep sense of inferiority are extremely suggestible. Many of the symptoms of neurotic invalidism are the result of suggestion from querulous relatives, newspaper advertisements, or injudicious "health" articles.

e. The attempts by the neurotic to attain satisfaction in life and to hide from himself his inferiorities are of a great variety. Unfortunately, the means used are inadequate for any lasting satisfaction or successful adjustment and give the subject only a temporary escape, after which his moody depression and self-deprecatory attitude returns with its introspective review of past difficulties and failures and a sense of futility of further effort. Frequently a neurotic tries to

cover up the discrepancies between what he is and what he would like to be by achieving successes and asserting himself in phantasy formation. This wish-fulfilling allows a temporary escape from immediate problems but soon a doubt creeps in or reality again forces the issue. Another refuge is that of hiding behind some real or imaginary ailment in which the neurotic sees himself as an invalid suffering from any or many of the neurotic illnesses of which gastric, cardiac, colonic, and nervous types are common. Behind such illnesses the patient attains security, refuge, and irresponsibility without loss of self-respect and without the stigmata of incompetence and cowardice. The neurotic frequently blames his environment for his failures but in the great majority of instances this is just further self-deception and a lack of a proper evaluation of his own shortcomings. The mechanism of projection in which there is a tendency to project one's own unfavorable qualities onto others so as to detract his own critical attention from himself is frequently observed in neurotic individuals. Another mechanism often used which depends to a great extent upon the extreme suggestibility of the neurotic is identification. Imitation of symptoms present in those who may be loved, respected, admired, or feared at times results from such identification. All of these methods are to be observed occasionally in the behavior of normal individuals but the neurotic seems to rely habitually upon such means in his efforts to adjust and consequently meet with little success, unhappiness, and general maladjustment.

SECTION IV

APPLICATION AND INTERPRETATION IN RATING FLYING ADAPTABILITY

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174. General.—In rating an individual's adaptability for any vocation, an attempt is made by using various tests, interviews, and observations to evaluate talents, abilities, intelligence, potentialities, and other aspects of the person concerned, and to conclude that he does or does not possess necessary or desired qualities for success. Actually, this is exactly what is aimed at in any personality study for in such studies an attempt is made to identify dominant, intellectual, emotional, and volitional traits of a given individual and to make a quantitative estimation of each. In rating flying adaptability the same procedure is followed, although at the present stage there is no full agreement as to just what constitutes flying ability nor are there very adequate tests to measure some of the qualities which are believed necessary in the pilot and which have been enumerated in chapter 1. Since successful trainees in the Army flying schools automatically become officers at the completion of their training and remain on active duty as Reserve officers under the present plan, the fact that one is also making a selection for officers as well as for flyers must be taken into consideration. While standards for this selection may be changed from time to time, the technique and interpretations for judging an individual will remain the same. The procedure which yields the most information concerning an applicant and which in spite of its many shortcomings is often definite and conclusive is the personality study. Appendix I contains a fairly detailed outline of personality study with especial application to selection of flying trainees, and for rating flying adaptability.

175. Purpose.—*a. Applicant.*—From the flight surgeon's point of view the purpose of making a flying adaptability rating is to—

(1) Study the applicant's psychophysical organization in order to determine whether this is normal or shows deviations therefrom. If the latter, whether so slight as to permit flying with or without limitations or such abnormalities which make flying unsafe either temporarily or permanently. Aspects especially considered are intelligence, emotions, psychomotor activity, somatic demands, and condition of the nervous system.

(2) Determine the applicant's manner of reacting to his environment, whether adequate or not, and whether it is likely to make for efficiency or inefficiency in flying.

(3) Determine as far as possible personality trends, potentialities, limitations, and existence of any latent tendencies which under stress of flying might become manifest and make for inefficiency.

(4) Classify as either qualified or disqualified.

b. Interview.—The ultimate purpose of the interview is to rate the flying adaptability of the applicant and to conclude that he is either qualified or disqualified. This final conclusion is often arrived at only after much weighing of assets against liabilities and it is the final general estimate of the individual which determines the rating. The score of 160 has arbitrarily been selected as passing and all qualified applicants must have a score of 160 or greater (see recapitulation, par. 1, App. I). This may necessitate revising the scores which should be done if the values given do not total 160 on an applicant that is found qualified. On disqualified applicants the score must be under 160 even though the preponderant evidence is favorable and only the definite history of an automatism, somnambulism, for instance, disqualifies. With experience one will soon learn to give values which approximate the 160 mark so that the score easily can be adjusted up or down according to the final estimate. It should also be remembered that under any heading there is a range of several values that may be given. Very few if any will be entitled to the full value permitted, for no one will be found quite perfect. The minimum values indicating an absence of anything favorable will also be used seldomly. The extremes of values should be saved for those who would present an ultimate in desirable or undesirable combinations of findings.

176. Methods.—The shortcomings of the methods used in rating flying adaptability are well recognized. The case history technique and subjective estimates made by the examiner lack much of the support of more objective methods. However, since an estimate must be made in the short period of a few hours, the methods used will furnish a surprising amount of information if intelligently conducted and properly interpreted. The application is the same as any good medical history in suggesting or making a diagnosis on an ailing patient. Although trainees are sought who possess those qualities which are felt to be essential for a flyer, it is on much surer ground to seek out those who definitely should not fly. Often positive estimates of this nature can be made in a very short time by the methods available, but without making the search disqualifications will never be discovered. It should be stressed, however, that qualified applicants are sought, and not to disqualify as many as possible.

177. Technique.—No rigid rules can be followed in making a flying adaptability rating, but a few general principles should be kept in mind. Each applicant should be interviewed privately and in a friendly, matter-of-fact manner. A quiet room with comfortable surroundings will permit relaxation and intimacy which is nec-

essary for the complete confidence of the subject and full cooperation on his part. While the material discussed in a personality study is to a considerable extent confidential, it is not necessary to make such a statement to the applicant unless such a question is raised. Some of the subjects are definitely of a private nature but most applicants realize that the examiner is asking questions that will be of help in determining his suitability for flying. It is best to do as little writing and note-taking during the interview as possible for if the applicant sees that everything he says is put down on paper he is likely not to be completely truthful in the more intimate details. Questions should be presented tactfully and worded so that the applicant can understand them. In general, questions should be in the accusative, for instance, "how much liquor do you use?" and not "do you ever take a drink?" It is best to discuss relatively impersonal matters first and leave the more intimate ones for the latter part of the interview. An easy subject to discuss first and which is logical in that it pertains to why the applicant has appeared is his interest in aviation, how long he has been so interested, and why he desires the Army training. From there reactions of parents, family history, etc., make logical order.

178. Family history.—*a. Biologic inheritance and setting.*—Biologic inheritance and family cultural setting are two sets of factors which may have played important parts in developing an individual's personality.

(1) *Biologic inheritance.*—Physical build, basic intellectual capacity, predisposition to the development of particular diseases or of certain personality traits may all depend upon biologic inheritance. The frequency with which such manifestations have appeared in parents, siblings, and other relatives indicates the familial and hereditary nature of those particular factors. The existence of insanity or other nervous diseases is to be looked upon as a possible background of instability with perhaps a tendency toward disorders of a similar nature. Even a history of conditions of lesser degree such as psychoneurotic manifestations or even mere eccentricities should be considered as possible evidence of transmissible instability which may appear under later stresses. However, the restrictions imposed by Army Regulations must be kept in mind in giving significance to isolated instances of nervous or mental disease. Paragraph 32a (1) states:

Inquire for psychotic and psychoneurotic manifestations in the record, and if such are found, examine carefully for degenerative modifications expressing

transmitted taint. However, if the candidate is found normal, then the isolated occurrence of mental disturbance in ancestors will be deemed negligible; the examiner will not overvalue the influence of direct heredity but duly weigh all considerations pertinent to the situation.

(2) *Setting*.—The family group which for the most part forms the early environment of an individual exerts great influence in the development of viewpoints, ambitions, and later lines of endeavor. Conflicts often appear during childhood and adolescence because the family setting often determined by racial, religious, or socio-economic factors does not conform to the common community pattern. Immigrant families frequently attempt to maintain traditional racial and family customs which often are at variance with their new American surroundings. Races seem to vary one from another as to their readiness to accept new ways, for example, it is said that Scandinavians readily become Americanized, while the French tend to cling to their old customs and resist assimilation. Growing children may develop conflicts under such circumstances with lasting effects on their personality as they attempt to conform to both family and extra family groups. In a similar manner, rigid, uncompromising religious codes or a particular economic stratus due purely to the money income may lead to conflicts with resulting personality colorings. Often it is of value simply to recognize the family background as having been laboring class, agricultural, commercial, professional, etc. Additional significant points will be suggested as specific information in the family history is considered.

b. Father.—(1) How old the father is and whether physically healthy; if dead, what the cause was, how long he was ill, and how old he was when he died; whether he had any nervous or mental disease, whether he was considered "nervous" in any way. Frequently one hesitates to admit or does not know that a parent was insane or suffered from a mental disease, but they may state that he had a "nervous breakdown," or that he died in a particular state hospital which may be recognized as one caring for mental diseases.

(2) How much education the parent acquired; what his occupation has been and how successful he has been at his work. Such information as length of time at the occupation, whether he owns his own business, whether he owns his own home or other property may throw light on the degree of success in his work.

(3) What the general cultural and social activities of the father are; whether he has taken any part in civic or social affairs; participates in any clubs, lodges, community political organization, P. T. A., or church activities; held any office; how he gets along with

people in general. Often the outstanding characteristics of a parent can be determined by asking the applicant to describe his father, to tell what some of his father's traits are, what his father likes to do, what his interests are, and what he does for recreation. Rather than the purely physical characteristics more interest is in such things as dominance, temper, sociability, nervousness, sensitiveness, worrisomeness, alcoholism, inability to get along with others, etc.

c. Mother.—The same information should be secured concerning the mother as of the father, remembering that evidences of possible instability which might be a part of the applicant's make-up handed down by heredity, and also to learn something of the cultural background of the applicant are being sought.

d. Siblings.—How many brothers and sisters; if any are dead what the cause was; how the brothers and sisters are alike or different; whether any show any particular abilities or talents or eccentricities which make them stand out from the rest (implying that the others lack that trait, or that they tend toward the opposite). Whether the children look alike; any of them show evidence of traits inherited from the parents; any more or less popular than the others due to good looks, or other traits; all considered competent in school and about the home; any preference shown, extra praise, etc., from parents; whether there is a family pet, black sheep, or family skeleton.

e. Adjustment difficulties.—How the members of the family have gotten along together; whether there have been any separations or divorces of the parents; if so, whose fault it was; whether due to any personality characteristics. Is there a feeling of family unity and do the members of the family stick together; does the subject feel that his family is better, as good, or worse than other families. Is there a dominant member in the family to whom the others look to for making decisions; any preference for either parent as being a pal with Dad, or mostly with Mother; one parent to whom he has always looked for sympathy or to whom he could go with his troubles. Any evidence of quarreling, envy, or dislikes in the family; why; were these troubles due to any personality characteristics of the applicant or other members.

f. Reaction of family toward flying.—Any conflict between the ambitions of the flying applicant and wishes and fears of family members; whether the attitude of the family toward flying is one of encouragement, indifference, or opposition. Often parents are violently opposed to young men entering flying training. Opposition to parents' wishes, particularly when those wishes are based on fear

for their son's safety, may lead to conflict in the trainee with attitudes of resentment or guiltiness, and poor progress due to worry, fear, and dissatisfaction. Certainly full encouragement and support by parents is desirable for all trainees.

179. Environment.—*a. Rearing.*—Was the applicant reared by his own parents, by one parent, or by other relatives. If step-parents or other relatives were a part of the family group during developing and influencing years, it is essential to consider them in the same manner as one would the mother or father. Often unusual family situations as being reared by a spinster aunt or a grandmother may produce profound effects on a growing child and probably no arrangement can fully take the place of normal, loving, solicitous parents. The uniformity and colorlessness of the routine institutional life of orphans lacks much that a good home offers.

b. Location.—Where the applicant spent his early years, in rural or urban surroundings. If he was reared in a city, how large it was. Country boys and city boys react differently to many situations for the latter have been exposed to and have reacted to so many more events. Modern travel however is obviating this difference to a large degree.

c. Age position.—Whether applicant's position as oldest, youngest, or middle child affected him in any way; has he been the "baby" of the family and consequently dependent, or had to assume responsibilities early and take care of his younger siblings. Is there a long interval of years between applicant and his nearest brother or sister; does he feel unwanted in the family. Is he an only child; an only boy with several sisters.

d. Economic conditions.—What the general economic conditions of the home were; was the family adequately provided for; in what type of house and in what type of neighborhood he lived. Was there any financial strain due to necessity for paying for illnesses, for educating children, etc. From a purely money standpoint, the conditions of his family were average, better than average, or poor.

e. Discipline.—How the children were disciplined; were parents strict or lax. Smoking or drinking permitted in the home; parents fussy or particular. What the nature of punishments was when administered; were they deserved; were they reasonable and consistent. What the reaction was to punishment; any resentment; did punishments do any good.

f. Interest.—What degree of solicitude was exhibited; was he permitted to have those things which boys like to have such as baseball bat and glove, skates, bicycle, pets, automobile, etc., according to the

family's ability to furnish them. Was there encouragement and interest in his progress, consideration of his wants, and appreciation of his accomplishments, or were all of these things lacking with an attitude of neglect, indifference, and discouragement. Did he have a hard time with many difficulties and hardships or were the members of the family helpful.

g. Principles.—What ethical principles were emphasized; were the principles of honesty, obedience, neatness, tolerance, stressed. Was the family "straight-laced," no swearing allowed, etc. Were the surroundings particularly religious. Often conflicts arise in the home out of rigid uncompromising attitudes. Are there any such conflicts apparent in the subject arising out of such situations in childhood which may have influenced the development of his personality.

h. Reaction.—In general, what the reaction is to his early home training and childhood surroundings. Was he happy or did the home environment make for discontent. Does he think that he had a good home; has he been rebellious; did he ever run away from home. Does he enjoy returning to his home for visits and has he been glad to take his friends to his home, or is he apologetic or ashamed of his family. Does he think that he has had as good a chance as most boys.

i. Worth.—Many may think that weights given to family and environmental history are not in proportion to their worth. However, it must be remembered that in the end the subject is to be estimated as to what he is which after all may be in spite of rather than because of earlier influencing factors. The facts of segregation in hereditary transmission or one strong influence acting during the developmental years may present a subject far different from that which would ordinarily be expected from his family and environmental history. On the other hand, in many instances, evidence of these influencing factors is seen and they often explain the why and wherefore of traits manifested by the subject.

180. Morphology.—*a.* Physical factors such as anatomical structure, state of nutrition, posture, relation of height to weight, prepossessing appearance, strength of voice, and others are of great importance in shaping personality development. Both hereditary and environmental facts contribute to this aspect through such factors as predisposition to disease, physical type, healthful food, climate, traumas, supervision of growth and development, preventive measures, etc. It is true that impressive stature and strength contribute definitely to traits of leadership whereas opposite traits commonly ac-

company an inferior physique manifested by weak musculature, awkwardness, blemishes, stigmata of degeneration or deformities. Just when certain factors as results of chronic illness or an awareness of small stature or other morphologic characteristics began to exert their influence on the personality can be determined by investigating developmental and growth period of the subject. Much desired information may be unknown or forgotten by the subject, and lacking definite evidence to the contrary such things as learning to walk and talk, appearance of teeth, and establishing habits can be considered as occurring normally.

b. Were there any birth traumas; was labor prolonged and use of instruments necessary. Any history of convulsions in childhood. Any unusual difficulties in childhood, eating, walking, talking which were looked upon as behavior problems. Was cerebral dominance established early. Were definite efforts made to lateralize to right- or left-handness and with what results. Stammering. Any serious illnesses resulting in residuals or sequelae; any history of deliria in minor illnesses; any injuries. If there is a history of illness or injury, did it necessitate any change in the life of the subject as long-continued invalidism during which time extra care and solicitude may have produced a demanding attitude. In general, is the subject robust, frail, or of average physique. Any evidence of characteristics resulting from a background of familial or hereditary disease. If there are any physical problems as unusual thinness or obesity, disproportions, poor figure, homeliness, scars, or disfigurements, have they resulted in any particular attitude; sensitiveness; worry; feeling of inferiority. There is no doubt that a sound body with good stature and build, prepossessing looks, a strong voice; in general, an excellent physique has much to do with developing favorable personality traits.

181. **Intelligence.**—*a. Importance.*—Of all the various psychological aspects to investigate and estimate in arriving at an applicant's adaptability, the intellectual activities are considered most important. Intelligence is given the greatest numerical weight in the scoring and out of the possible total of 200, 60 points may be scored by this item alone. By reference to intelligence usually is meant the capacity to deal effectively with new situations, and to understand new problems by applying the results of past experience. Intelligence is often called problem-solving ability, and if one has this ability to a high degree and demonstrates that he can and does use it, then many of his shortcomings may be nullified. On the other hand, if there is only mediocre or a low degree of intelligence, much

achievement cannot be expected even though many other aspects may be very favorable.

b. Definition.—It is probably impossible to define intelligence more definitely than to say that it is the ability to meet and to adjust adequately to life's situations, but if this concept is kept in mind there are several closely related psychological operations which can be investigated and from which this intelligence can be inferred. While intelligence is not synonymous with them, it is nevertheless closely related to such processes as learning, memory, attention, comprehension, judgment, and tact. The presence and the degree to which these are manifest serve as evidences of intelligence in the subject. Each is considered more fully in *d* below.

c. Related factors.—(1) *Educational career.*—One environmental situation which all individuals have to face as they grow up and which fortunately is becoming more and more standardized is schooling and education. Upon entering the complex environment of the school and playground, an individual is faced with new group situations calling for many give-and-take reactions, and to meet satisfactorily these new situations demands a capacity for flexible adjustments (intelligence). Besides this, the quality of their purely academic achievement in the progress through the various educational levels can be taken as an index of basic intellectual capacity, so one of the first things to investigate in attempting to estimate an individual's intellectual potentialities is his educational career.

(a) At what age he started school; how many years spent in grammar school, high school, college, other schools. How old he was when he finished high school; were frequent changes from one school to another necessary; why; were schools public or private. What the size was of schools and classes attended; any difficulties in keeping up in the class; did he have to study especially hard to keep up. Which subjects were preferred, which disliked. Any special abilities or disabilities evident; ever skip a grade. On the whole, what his standing was in his class, upper, middle, or lower third.

(b) Any failures. If there were failures, what subjects were failed and in what year; what reasons given for the failures; lack of interest, illnesses, too much outside work, too many other activities, blame the teacher. What he did about his failures; leave them or make them up. Did any examination, or other situation ever upset him so that he felt he could not face it. Did he ever become actually ill or leave school rather than face some such situation. What the attitude of the subject and the attitude of his parents were toward his failures.

(c) How the subject has reacted to school; has he found school work easy or difficult; interesting. Was he conscientious about his work; did he enjoy it. If not, why not. Did leaving home to go away to school constitute a problem or conflict. Was he homesick. Who financed his education. Was education continuous or were there gaps and long intervals. If schooling was discontinued what the reason was; financial, failures, lost interest, completion of course. Has there been a definite choice of career and determined goal as the objective of subject's education.

(d) When the academic educational history has been formally investigated, it is the examiner's task to evaluate the findings. In general, it can be expected that an individual of average or above average intelligence will have few or no failures. The work at educational levels up through the high school grades is fairly well standardized and is constructed so that average ability can accomplish it satisfactorily. Certainly trainees are desired who have had better than a lower third standing in their class through grammar and high school. Often achievement must be discounted when a subject stood first or second in his class, but it is found that there was little competition in a class of eight or ten.

(e) College work accomplishment requires better than average intellectual capacity, and many individuals apparently succeeded well through high school but as soon as they were up against college subjects began to show failures, conditions, and low grades. Selecting flying trainees is definitely seeking a superior adult level of intelligence which is required to complete 2 years of college work with average or better standing. Failures in college work should be interpreted carefully as possibly indicating only mediocre or average intelligence.

(f) Sometimes adequate reasons are given for not having accomplished scholastic work. The examiner must candidly evaluate the reasons given and decide whether they are adequate or whether they are evidences of rationalization on the part of the subject. Whether the subject has as much education as he should have for the opportunities he has had; in the examiner's opinion, has his scholastic standing resulted from superior intelligence, ease of acquirement, lack of drive, unbalanced urges, deficient intelligence, or some other factor. Has excessive application been required; does his academic accomplishment indicate above average, average, or deficient intelligence.

(2) *Adjustments.*—(a) The educational period when much time is spent in the school and in play groups, and also the work life following presents many varied situations which call for flexible adjust-

ments. The degree to which satisfactory adjustments are made to these situations is definitely evidence of intelligence in the broad sense. Considerable can be learned of this aspect from the extra-curricular activities entered. What evidence there is which demonstrates the subject's ability to get along well with others and to make friends; belong to any clubs, orchestra, choir, debating team, or dramatic activities; member of a fraternity; in these activities an officer or committeeman. Hold any office in his class. Participate in athletics; to what extent; intramural or on the school team; what position played on teams; evidence that he has athletic skill; win any letters; go in for individual sports or for group athletics. Did he cooperate well in team-work; how he took defeat; whether a good sport.

(b) The significance of responses to many of the questions just suggested may pertain to some of the topics below, and will be considered more fully when those aspects are taken up. For instance, indications of desire for companionship or of the individual drives may be obtained from studying these extra-curricular activities of the educational period but will be specifically interpreted when sociality, psychomotor activity, etc., are considered.

(3) *Work life.*—(a) The work life of an individual during the summers and after leaving school and his later occupational history furnishes additional information on the same issues as have just been considered in the educational history, but further indicate particularly his capacity for successful adjustment. The competitive nature and the "hard" reality of facing the work situation calls for initiative and independent action not previously demanded. It is desirable to follow the subject's life through his school years and up to the present, and consider chronologically his entire work life; there should be no gaps of months or years of which nothing is known. How old he was when he earned his first money; was it an after school, part time, or summer job? What jobs he has held; what salaries received; any promotions. How his jobs were secured; how long he kept them; what reasons given for changing or losing jobs. Has he been unemployed for any length of time; what his attitude is toward unemployment; has the work life been along one type of occupational endeavor. Any special abilities or disabilities which have determined choice of work. Has the education acquired been put to practical use in work life. How he has gotten along with his employer and fellow workers; what the attitude is toward unions.

(b) Since selection for the Air Corps contemplates future military service, it is important to investigate any previous service. Any time ever spent in the Army, Navy, Marine Corps, etc.; reasons for such

action. How he got along with noncommissioned officers, fellow men, and superior officers; any disciplinary action ever taken. What type of work he did while in the service; receive any promotions or ratings. The situation between enlisted or commissioned personnel in Government service is not greatly different from other employer-employee relationship. One who by previous record has demonstrated poor adaptability to the service or who has a definitely unfavorable record (courts-martial, disciplinary actions, etc.) should certainly not be acceptable again. Further, those who have spent whole enlistments (three year) without advancement in rating, and others who at Government expense have been given training leading toward other commissioned service (West Point, Annapolis, prep schools, etc.) and have failed are lacking in something being sought. Considered as either lacking in drive or as having only mediocre or less endowment, it is not believed that individuals with such records should be given another chance and further trained at Government expense in order to obtain such doubtful assets.

d. Processes.—Keeping in mind the concept that the criterion of effective mentality, that is, intelligence, is to be observed in the facts of adjustment to life's situation, those processes which are so closely related to intelligence that they cannot be looked upon as independent operations are—

(1) *Learning.*—(a) Learning in the broad sense includes acquired knowledge as well as all the modifications of adaptive responses which result from experience. To have adapted well suggests that one has learned well and that he therefore has the inherent impressionability necessary for many modifications of varying complexity. Learned material is acquired material and depends upon exposure and experience. Learning is therefore the receptive and acquisitive aspect of mental activity. And here again the environmental situations pertaining to the educational system furnish a fairly uniform experience to which all are exposed. Good success in school work can be looked upon as evidence of good ability to learn. There may be in addition a record of ease in learning along some particular line, indicating special talent as definite mechanical ability, ability to draw, athletic ability, etc. What evidence there is of this, do the accomplishments indicate a capacity to acquire any special material. Any good athlete, for instance, must have the capacity for learning to coordinate motor movements quickly and effectively. However, indications of special abilities with ease of acquirement therein are not to be looked upon as evidence of high general intelligence for the correlation between tests of the two is low. Of course, many highly intelligent individuals

also have special abilities and in many vocations such combinations are essential. In aviation where so much depends upon good coordination between eye, hands, and feet in the movement of controls, it is important to keep in mind the importance of ability to learn motor movements. That is why evidence of good athletic ability is always desirable in a flying trainee, for he has already demonstrated his ability to learn complicated motor movements.

(b) Speed of learning is an important adjunct to capacity to learn. Some finally acquire the desired modifications, but only with difficulty and after prolonged repetition. How the applicant compared with his classmates in scholastic progress; did he ever have to repeat a grade; in acquiring knowledge and in his scholastic progress has he manifested a fast, average, or slow rate of learning. By evidences of manual dexterity or awkwardness, and by athletic ability, is his rate of motor learning fast, average, or slow.

(c) The inquisitiveness of an individual as determined by his store of general information further aids in estimating capacity to learn. Can he talk about many things; is he familiar with important facts and current events of the day. Such questions as the following are suggested: who is Vice President; Governor of your state, mayor; who are prominent opposing labor leaders; some cabinet members; who won the World Series; where was the last World's Fair. Also, any current events as chosen from topics prominent in the daily newspapers can serve as subject for questioning. What his views are concerning education, the social order, government, trade unions, etc. In general, does his general information show good inquisitiveness or is he lacking in knowledge and ideas of practical affairs.

(2) *Memory*.—(a) To isolate memory and consider it as a process completely separate from learning is impossible. Similarly, other operations as attention and perception are so closely related to these and to each other that they are truly interpenetrating and interdependent. Memory, however, is used in a broad sense to refer to retentiveness, and to ability to recall past experience. It is memories which determine to a great degree how adequately will be adjustment to rapidly changing environment. Present interpretation and adjustments to present situations are made in the light of remembered past experience, and how adequate this will be depends on how logical or illogical are the memories concerned.

(b) In objectively testing memory, consideration is given to retention for immediate, recent, and remote events. For retention and immediate recall the standard tests in use are satisfactory such as immediate repetition of a series of numbers, or remembering a name

and address immediately and after a 5-minute interval. In administering these tests the procedure first should be explained to the subject. In the serial number test, the numbers are read at the rate of one per second without spacing into rhythmical groups and without inflection of the voice. An average adult should succeed in repeating a group of seven numbers once in two trials, using a different series if the subject does not succeed the first time. Series typical are 4825917, 1538276.

(c) Recent memory can be checked by asking such questions as what was served for breakfast, or for the evening meal the night before, or to have the subject review activities of the day before, and of a week ago. The remote memory can be estimated from the manner and certainty with which the subject has discussed his childhood, educational history, work life, in which he makes statements as to date and place of birth, serious illnesses, schools attended, age at which high school and college were finished, jobs held, etc. All these depend upon remembering more or less remote facts.

(d) In interpreting this memory function aim to judge whether the memory is good, average, or poor, and whether any defects of memory exist. The burden falls on the examiner to judge whether statements made are accurately remembered (age and date at which events occurred often won't coincide when calculated from date of birth), and whether or not true memories are falsified or deliberately withheld from the examiner. Too, it must be remembered that while remembered facts may reach back to the third or fourth year of life, events prior to that age are usually completely lost. A complete loss of memory for a limited period may have resulted from some injury or be due to some psychogenic factor. While amnesia following a head injury and covering only the period of the injury may receive consideration for waiver in the case of rated pilots and observers and others on a flying status, amnesia due to either psychogenic or organic cause, or any other pathological defect of memory is to be considered as disqualifying in original applicants.

(3) *Imagination*.—The transpiration from the active imagination of childhood by which visionary playmates are mistaken for reality to the practical controlled foresight of the mature adult is a gradual process. One who daydreams a great deal and who solves his problems and seeks satisfaction in phantasy has persisted too long in his childish habits; he is unable to distinguish between what imagination creates and what is fact, and is apt to be somewhat impractical. On the other hand, it is only by using one's imagination that an ultimate goal can be kept in mind toward the attainment of which

well planned efforts may have to be directed over a long period of time. How well one has planned for the future and how well he has solved his past problems is an indication of how practical is an individual's imagination. When faced by a new problem, imagery presents a number of possible ways of solving the new problem and brings past experience to bear on the present situation, so imagination is an integral part of the intellectual activities, and none of these processes can be entirely separated from the others. Actual objective tests to demonstrate imaginative ability are interpretations of ink-blots, or of cloud formations, or the "painted-cube" test. A splotch of ink can be kept available and the subject is asked to tell what it looks like to him. Almost everyone sees something in an ink-blot and from the responses the fertility of his imagination can be estimated. Experienced examiners claim that responses to standardized ink-blots reveal a great deal of an individual's personality when properly interpreted (Rhorschach method). In the cube test, one is asked to imagine a 3-inch cube painted on all sides, cut up into 1-inch cubes. The subject is asked to tell how many cubes have paint on three, two, one, and no sides.

(4) *Attention*.—(a) Considering this aspect of mental functioning is referring to capacity to direct conscious processes toward a particular stimulus and then to maintain the stream of mental activity in that direction. The phenomenon of attention relates closely to the field of reception and therefore plays an important role in learning. Whereas in one sense span of attention refers to the number of things that can be attended to in a very brief span of time (four to six objects), in the more practical sense span of attention refers to the range of things attended to over a space of minutes or hours. One may ask the subject to tell of some of the things which he has observed (attended to) during the time he has been in the examining building (the activities and chance to observe them being essentially unchanged from day to day). From this one finds whether few or many things have been attended to. From his inquisitiveness and general knowledge as already discussed above, one further gets an idea of the range of objects attended to by the subject. The span should be rated as good, fair, or poor. More specific tests for control of attention that may be used are to ask the subject to count each "e" in a selected paragraph and see how many letters he misses, or read a list of numbers and have the subject tap each time the number "3" is mentioned, 23759463290146372934853018. One can learn a great deal about the attentiveness of an individual by just observing him during the examination. Instructions in the dark room or during the physical

examination, and questions asked during the interview are often neglected because the subject is not paying attention to the thing at hand. The surroundings, the activities of others in the room, or what he sees through the window claims his attention and he is inattentive to the examiner. Instructions and questions have to be repeated. If such a state persists throughout the examination, the individual can be called inattentive and it may be due either to increased distractibility or due to apathy. In the former there is little capacity to control and direct the attention toward one effort for very long, and any new and changing stimuli claim the attention. If apathetic there is such a lack of real interest and feeling toward the examination that the subject makes no effort to attend or cooperate.

(b) Has the whole life of the subject shown evidence of impairment of attentive ability, distractibility, or the opposite of distractibility, increased tenacity of attention; as evidence of this latter, many examples of "absent-minded" behavior. Has the subject often become so preoccupied with his inner thoughts and experiences that he neglects or hardly responds at all to the ordinary stimuli of his environment. During the examination this tendency toward preoccupation may be manifest by an excessive mental inertia in which the subject lacks ready answers, repeats questions, and otherwise stalls for time in which to pull away from his inner preoccupation. Any definite impairment of attentive capacity either toward distractibility or "absent-mindedness" is to be given its due consideration in relation to the other intellectual processes in the final scoring. The desirable type has demonstrated a good span of attention and shows good control by an attentive attitude toward the examination, cooperativeness, and ready responses.

(5) *Perception*.—Estimation of this important mental aspect is best accomplished by observing the interpretations, identifications, and responses of the subject to stimuli in the various phases of the examination. Perception is the understanding and interpretation of situations based on meanings that have been given to these same stimuli as a result of past experience. In the eye department, the ability to identify objects in the dark room, screws to twist, rods to move, dots and lines of light; the identification of sound and pitch changes with the audiometer, the perception of the numbers and mazes on the color vision cards, etc., throughout the whole examination all help in estimating perceptive ability. The perceptive ability of the subject is to be judged by such objective means as well as by any specific instances in his history which might give similar information on good or poor perceptive capacity (accidents resulting from

misinterpretation, etc.). On the whole perception will be judged as quick or slow, and as accurate or inaccurate. The presence of disturbances of perception to the degree that they can be considered illusions or hallucinations will hardly ever be found in supposedly normal individuals applying for flying training. The existence of such, however, would be considered disqualifying as suggestive of some more serious mental disturbance.

(6) *Comprehension*.—Comprehension refers to capacity to understand situations as a whole, to appreciate relationship between objects presented to the senses which at times create very complex situations. Some individuals do quite well in understanding simple situations in which only a few details are involved, but when the problem becomes complex or when they attempt to relate a few minor details which they understand to the situation, their appreciation breaks down. Individuals who are mental borderline cases may do very well with simple situations but may have difficulty comprehending another situation because of the larger scope of details involved. This aspect is best estimated by the understanding of whole situations as evidenced by behavior throughout the examination; the comprehension of the depth perception test, phorometer test, understanding of questions in the adaptability rating interview, etc. After a delay, some grasp the idea, others never do or only after extra detailed explanation.

(7) *Judgment*.—Judgment refers to the ability of an individual to reach conclusions by properly evaluating the various aspects of a situation in relationship to one another. Judgment then is definitely a manifestation of intellectual activity, for the effectiveness with which one deals with life's problems often depends upon good or bad judgments pertaining to the situation. Plans and decisions as to action to be taken depend upon judgments. In his reactions to specific situations (accidents, fires, being lost, nearly drowned) has the subject shown good or poor judgment; how well has he planned as evidenced by his life history; does he weigh all the pros and cons. What his reasons are for wanting to learn to fly; does he know the possibilities as to his future in military aviation or is he going into flying with vague ideas as to what might be ahead. To state briefly just what makes good or normal judgment would probably be impossible, but the following factors relative to variations in judgment frequently encountered will indicate desirable characteristics.

(a) *Speed*.—Speed in making judgments is certainly desirable and yet all are aware of those individuals who characteristically "jump at conclusions." Too often their judgments are faulty, based upon

superficial appearances, and are not justified by true relationships. Impulsive behavior is usually of an unusually quick nature and frequently suffers because of lack of appreciation of the true state of affairs. Impetuosity and other actions of a hasty, rash nature usually show a lack of well based judgments. While weighing facts is essential for making good judgments, undue deliberation with hesitation until one makes judgments very slowly or not at all may be as disastrous as impulsiveness. Because of their native low endowment of intelligence, some individuals may reason so slowly that they reach their conclusions only after a prolonged time.

(b) *Decisiveness*.—As to decisiveness or indecisiveness, have the subject's judgments been of a positive, final nature, or have they been inconclusive and unsure. Quick, accurate judgments of a positive finality on which actions may be based are of course the best type. There is no doubt that with experience and increased knowledge come a maturing of judgment which could not be present in earlier years. Judgments of the child or adolescent youth are so often irrational because they are not based on sound reasons. Impracticability also frequently characterizes these immature judgments so that failures and inadequate solutions follow their unsound decisions.

(c) *Finances*.—One situation with which most individuals deal to a greater or lesser extent and which often furnishes information concerning their judgment is the handling of their finances. Have finances been well handled or poorly handled; any money been saved; has he been an "easy mark" for swindlers. While the opportunities for earning, accumulating, handling, spending and dissipating money must be taken into consideration, one can often learn a great deal from securing data on this point.

(8) *Tact*.—A behavioral adjustment indefinitely related to the concept of general intelligence but probably dependent upon an ability to make quick and accurate judgments and act accordingly is tactfulness. While depending to a great extent upon experience and training, tact is essential in maintaining smooth, interpersonal relationships. Often circumstances call for entirely different types of behavior in almost identical situations and the adequacy with which an individual adjusts in his daily social relationships with other human beings by saying or doing the appropriate thing is a measure of his tactfulness. Has the subject by his past behavior or by his manner, speech, and action during the examination demonstrated a lack of this "social intelligence"; has his life been characterized by tactlessness; does he say and do the wrong thing habitually. If so, does it seem to be intentional as prompted by social rebellion,

or as possibly a manifestation of an antisocial make-up, or just due to a lack of this "social insight."

e. Rating terms.—In concluding this most important subject of intelligence, it is suggested that the examiner take a broad view of the applicant's whole life, and rate him in terms of how well or how poorly he has adapted. In general, how well he has met the situations of life up to the present date.

182. Achievement.—Achievement is a broad term. Included are such factors as ambitions, drives, accomplishments, thwartings, conflicts, and self-evaluation. All will be considered, together with reactions to these factors, and the part they play in determining success.

One thing being recognized more and more as the result of continued psychological studies is that the average man is satisfied with an extremely mediocre performance. Few human beings approach the maximum of which they are capable either in effort or in accomplishment achieved. The reason for this disproportion between what an individual actually achieves and what he could achieve may be accounted for by the interference or effect of certain influences such as health, interest, ambition, encouragement, and moral support, and by opportunity which may be limited by the general economic situation or by responsibilities toward others. Also, such personality traits as timidity, sensitiveness, uncontrollable temper, aggressiveness, persistence, etc., may play a part. All these must be considered as possible influencing factors in achievement.

a. Goal.—(1) The individual who is able early in life to set for himself a definite goal and who lets nothing divert his efforts from that goal for very long at a time is fortunate indeed. A great number of adolescent youths and young men just out of school approach the threshold of their work life still groping, uncertain of what they want or of what they are fitted for.

(2) Whether the applicant had any ambitions as a youngster; what he thought he wanted to be when he grew up, a policeman, a fire chief, a farmer. When did these childhood ambitions give way to more mature desires, or have original ambitions persisted. If a definite vocation was selected early, did courses taken in high school and college aim toward such a career; were related subjects the ones which the candidate liked the best, showed the most interest in, and the ones which he accomplished satisfactorily; did he change courses, for instance, medicine to law, to journalism, to business administration, etc.; why; due to lost interest, lack of definiteness, of aptitude. What sort of work he has done in between school years; did it pertain toward his ultimate goal. Having acquired knowledge of some voca-

tion, has he put it to any good use, applied it, or earned money with it since out of school.

(3) Having considered the early and later goals of the applicant, the question of his present desire to learn to fly should be investigated. How long he has been interested in learning to fly; when he first got the idea that he wanted to take training in the Army Air Corps Training School; has he shown any real interest in aviation in the past; how many aerial flights he has had; what his reactions were thereto; was he airsick. Has he definite ideas as to why he is applying for flying training; does he know what is ahead of him 1 year from now, 3 years from now. Does he know what the possibilities are for a career in the Army; in civilian aviation. Has he a definite ambition now, and what he wants to accomplish in life as a result of his present desire to learn to fly. Is he vague and indefinite as to his goal and unsure of what the possibilities are. Are the reasons for his desire to learn to fly sound or unsound. Is he really hoping to make a career out of flying, and earn his livelihood, success, and happiness from this work, or is he intentionally applying for flying training as an admitted avocation after which he intends to go back to some other already selected life career. Either reason may be sound, for with increasing advances and applications of aviation flying is claiming the interest of more and more as a hobby. However, when individuals state that they are applying for flying training because they hope to become radiomen, airplane mechanics, meteorologists, airplane designers, or give such vague reasons as "there seems to be a good future in aviation," one should question the soundness of their choice. In summarizing their present ambition, is the decision based on logical factors; is there a real interest, and is this interest of long duration and are plans for the future based upon this action, or is this application just another thing to try; perhaps almost a last resort after failures in other jobs, or as the result of long unemployment.

b. Drives.—It has already been pointed out how desirable it is to have one major objective in life toward which all an individual's trends seem to focus. However, it is also desirable that there be minor interests toward which attention, time, and efforts may be directed regularly and frequently for diversion and recreation. Does the subject have any definite minor drives which may amount to a real hobby or avocation, or a less definite urge or interest in such things as athletics, acting, etc., either as a participant or observer. What the subject does with his spare time; is there some sport of which he is a devotee, hunting, fishing, or some definite hobby as collecting stamps, guns, building model airplanes, photography, etc. Cultural interests

as reading, music, painting, dancing, urges for companionship and social participation are all to be considered as minor drives as well. Some of these will be more fully discussed under sociality (par. 186). Do these minor drives ever gain the ascendancy in their claims on the time and money of the subject. The major vocational pursuit should never be displaced by avocational interests. The most favorable finding therefore is for there to be a definite major drive toward which organized, coordinated, and sustained efforts are directed, besides which a definite hobby or hobbies or avocations serve as diversion. The important thing is whether he is able to keep the selective motive dominant; whether his efforts are strong or weak and are focalized toward the goal or not.

c. Conflicts.—(1) To discover existence of any real conflict in an individual during the brief study given to a flying cadet applicant may be impossible. On the other hand, certain manifestations of adjustment mechanisms may be so obvious that the presence of a conflict, perhaps an unconscious one, can be assumed almost certainly. Evidence of habitual projection, for instance, suggests existence of shortcomings within the individual, which thwart his success, and which cause him unconsciously to project his faults to others. At times, however, definite conflicts are consciously recognized and obvious reactions made thereto. It has been mentioned that conflicts may develop in childhood situations where racial, religious, or socio-economic factors of home environment are at variance with the common community pattern. These conflicts may persist to the present or others may develop as the result of financial handicap or lack of opportunity in the existing world economic condition. Thwartings and resulting conflicts, often unconscious, may result from other handicaps in intellectual, social, or physical spheres.

(2) An admission of phobias, anxieties, unusual fears, or compulsions are to be taken into consideration as possible evidences of some underlying conflict. Existence of any of these should be disqualifying for flying training. A phobia, for instance, of inclosed, constricting areas, is at times encountered, and it can be seen easily that in such a person a strong emotional reaction could possibly be provoked by flying into fog or even clouds. Compulsions and mannerisms may be present as symbolic movements, and be manifestations of unrecognized stresses, and when interpreted in this light, they serve as evidence of unsolved conflicts. Mannerisms are discussed also under somatic demands (par. 185). In a flying adaptability rating it is not intended nor indicated to analyze and seek out the basis of an existing conflict. Existence of few or many conflicts and adequacy

with which they are met is the essential upon which opinions are based.

(3) Each and everyone has been frustrated in many undertakings of life and each thwarting is a potential cause for conflict. The important thing is how these thwartings have been met, what insight there is into capacities and limitations, and what measures have been used in adjusting to disappointments. The reactions to these situations may habitually be satisfactory and adequate, or they may be unsatisfactory and inadequate. Of the latter type there may be evidence of a tendency to shrink, or of frequent retreats from reality, with excessive daydreaming and solution of conflicts in phantasy. Is there evidence of such reaction, or of other inadequate mechanisms being used by the individual in his attempt to meet life's situations; projection; identification; rationalization; compulsions; anxieties; others. Sometimes feelings of inferiority and insecurity in an individual will be manifest by uneasiness in the presence of strangers, inability to make friends easily, or sensitiveness to the feelings and opinions that others hold of him. Even such reactions as being proud or vain, jealous, apprehensive, complaining, or being unduly fussy about details or about one's dress may all be looked upon as possibly reactions motivated by a sense of inferiority.

(4) Satisfactory adjustments to conflicts may be made by obvious sublimation with acceptable substitution, or by adequate compensations. Compensatory behavior is one of the most frequent methods of solving conflicts and is utilized by almost every individual to some extent. However, logicalness, adequacy, and nature of compensatory activities vary greatly. Has the subject developed any skills by which he gains recognition and which make up for his shortcomings; are these compensatory activities logical in that they are attainable and within the capabilities of the individual, or does the subject affect a superiority in some line, obviously not commensurate with his capabilities; have the compensatory activities been adequate; have they brought deserved recognition and a satisfactory adjustment, or have they been inadequate due to poor choice of the type of activity undertaken, or due to inferior ability all around.

d. Accomplishments.—How the subject feels as to his present status in his progress toward any selected goal; does he feel satisfied with his accomplishments up to the present time or have they been unsatisfying; does he believe that he has made the most of the opportunities offered; what the examiner's opinion is on this point. Does he seem to have had good chances, and has he taken advantage of them when they were presented.

e. Self-evaluation.—(1) Self-estimation or self-criticism is a natural process in all, though it is too frequently done unconsciously and in a self-deceptive manner. There is no doubt that it is desirable to have insight into one's own capacities and limitations. How the subject estimates his own capabilities; whether he takes the objective viewpoint and "—he knows what he can, what he cannot, and consequently, what he ought to do." Certainly good objective self-criticism forces a person to recognize weaknesses and also strength of his personal equipment. Does the subject take the subjective viewpoint and compare and estimate himself unconsciously. The failure here to adopt an impartial and objective attitude results in self-deception with repeated self-justifications by rationalization, projection, and other undesirable reactions.

(2) The subject has what degree of insight into his own capacities, limitations, motives, and driving forces; how good a judge of self he is. Individuals vary greatly in degree and success with which they analyze themselves. Some individuals are always so concerned with activities of the world about them and in things outside themselves that they seldom direct their thoughts toward their own person. Others introspect a great deal. All persons have some qualities which are favorable, and also some that are not so favorable. If this is pointed out and the subject is asked to tell what his favorable and unfavorable characteristics are, something about his self-estimation is ascertained. There are many who, because they have never taken an objective look at themselves, seem unable to name a single quality about their own person, either favorable or unfavorable. Others are ready and give definite and positive estimations of themselves. How these self-inventories of assets and liabilities compare with the examiner's estimations.

f. Mental stability.—Achievement of any degree depends to some extent upon mental stability by which is meant ability to keep certain selected motives dominant. Toward one's aims, a mentally stable individual will direct sustained and coordinated efforts. Mental stability reflects judgments used in selecting goals, vision and imagination necessary to maintain enthusiasm, and foresight as revealed by plans of action for its accomplishment. In final estimation and scoring of achievement it should be recognized that achievement and intelligence in the broad sense are closely related. Success in solving life's problems and making adequate adaptations to life's situations constitutes achievement as well as indicating intelligence. For achievement, besides noting isolated accomplishments, consider how well the individual has coordinated his whole life.

183. Psychomotor activity.—*a. General.*—Under this heading interest is in determining general activity level of the subject, considering both mental and motor aspects. Closely related are such things as output of energy, strength of drives, and volition. It must be realized that here as in everything individuals differ greatly from one another. At one extreme is the underactive, slow, inert individual in whom not only the motor manifestations, but also the stream of mental activity is characterized by sluggishness, desultoriness, lassitude, and low energy output. These are the slowpokes who drag themselves along; they are lethargic, and need prodding in order to accomplish much. At the other extreme are the overactive, bustling, energetic, talkative, enthusiastic individuals who manifest an apparently unlimited ability to expend energy. They are vivacious, "peppy," and restless, and rush through everything they have to do. Not only the physical activity but the thought processes as well show this hyperactivity. Somewhere between these extremes fall the average levels of psychomotor activity and in various combinations manifestations of all degrees of these two extreme types are found. Evidence of hyperactivity or of hypoactivity; does the subject move and talk with average speed, or is he quick or slow; overtalkative; does he seem to prefer to listen. As attempt is made to evaluate this factor of activity, it is important to recognize the forces which motivate the levels seen. Some have intense drives and wide interests, and in some, powerful impulsions force violent action. General health or some basic metabolic condition may be a contributing factor. Certainly one debilitated by a chronic ailment or one suffering from hypothyroidism cannot and does not function on as high a level as one in vigorous health.

b. Efficiency and effectiveness.—Another consideration of psychomotor activity is efficiency and effectiveness with which energy is expended. Many bustling, overactive individuals give the impression by their pressure of activity that they are accomplishing a great deal. On closer examination, however, it may be seen that their efforts are nonpersistent, poorly directed, uncoordinated, and actual accomplishment is practically nil. On the other hand, the slow, methodical, steady individual may show great accomplishment with minimum wasted energy. These variations are in some instances due to impulsiveness, or presence, or lack of deliberation, and inhibition in the individual. Impulsiveness has been already considered, and should be taken into account in making final estimation of psychomotor activity. Terms which are often used referring to psychomotor activity are "trained" or "untrained," meaning that the individual

has attained or has not attained a control and coordination of his energy output resulting in efficiency and effectiveness, regardless of what he undertakes. One who is "trained" accomplishes his undertakings in the briefest period of time and with the least amount of effort. He is efficient and effective. "Untrained" means just the opposite; excessive energy output, poorly directed efforts resulting in little accomplishment. How well the subject has directed and coordinated his whole life; is he standing still; have his accomplishments been adequate and in accordance with the effort expended; are the accomplishments the results of any particular skills or aptitudes which have been developed and put to good use; if so, have these been developed to their maximum efficiency.

c. Style.—Perhaps still another aspect of this subject of psychomotor activity is that of style. Some individuals seem to have their own unique way of doing things which becomes so characteristically associated with them that their works are often recognized as if there were a stamp or label on them. Has any such individuality been displayed in the behavior, work, or habits of the subject. Most likely, in a limited interview, one will not be able to discover anything that might be considered as an individual style. There might be quite obvious evidence such as stubbornness all along the way, set ways, fussiness, unusual orderliness or neatness, etc.

d. Disposition of time.—As has been suggested, drives, interests, avocations and hobbies account for a great deal of the activity which is considered in this section. The discussion of these subjects above as well as the degree of social participation discussed below should all be taken into account in estimating the final level of psychomotor activity. Particularly, have efforts toward the major drive been well-planned, coordinated, and persistent; do accomplishments seem adequate and in accordance with time and energy expended; has there also been a favorable degree of activity along other lines manifested by a wide range of interests, and active participation in numerous activities of a recreational, cultural, and social nature; has the time factor been well-balanced; finally, at what level does this individual habitually function, what his potentialities are as to energy output and efficiency in its expenditure. An individual who has well-controlled movements and properly directed efforts free from haste and spurts of activity, keyed to a healthy, normal rate of speed has the greatest possibilities.

184. Emotional content.—*a. General.*—(1) There is no aspect of mental functioning which is more difficult to analyze and evaluate than that of emotional content. At the same time it is one of the most

important constituents of personality, and through its influence an individual's adjustment possibilities and habitual types of behavior are colored and modified more frequently and more seriously than ordinarily is believed. It is often very difficult to arrive at any accurate estimation of this aspect, for feelings and emotions are often masked and the objective study of temperament has not advanced very far up to the present time. Some observations can be made which often have significance as criteria of the individual's emotional make-up. Such things as facial expression, postures, attitudes, tenseness, motor movements as gait, gestures, restlessness, and fidgetiness should be considered. Tears, blushing, mottling of extremities, sweating, tachycardia, increase in blood pressure, sighing, tremor, and pupillary dilatation may be present as objective signs of an emotional state. They are often of no help, however, in determining the prevailing mood of the subject and especial interest is in determining what the habitual pattern of expression is, the probable manner of reacting, and how this may affect relationships with others or the success in undertakings. It is desired to know about his more or less settled emotional reactions; whether he is cheerful, easygoing, jolly, timid, gloomy, anxious, irritable, depressed, suspicious, sullen, embarrassed, cynical, etc.; whether the emotional component corresponds with the psychomotor activity. Affectivity often colors to a considerable extent the psychomotor activity. A cheerful, enthusiastic, "peppy" individual usually showing liveliness and quick, restless activity, is talkative, and shows general vivacious behavior. The psychomotor activity of a depressed, gloomy, sullen person is often the opposite. Is there a general optimistic or pessimistic outlook on things; is he frequently anxious and worrisome; irritable; discouraged. Sometimes definite information can be secured by getting the subject's own description of his affective state. Such a question as "How are your spirits as a rule?" will often bring forth important information. Obvious embarrassment, lack of poise, ill at ease should all be taken into consideration as evidences of emotional responses.

(2) The emotional content should be evaluated from as many viewpoints as possible. It is desired to consider susceptibleness to and frequency of changing moods; then to know emotional breadth and emotional strength, and finally appropriateness, in both quality and degree.

b. Change.—Is the subject liable to marked changes in his moods and spirits; does he admit that he has his "up" and "down" days; does he get the "blues," spells of elation. How frequently do such fluctuations occur, and for how long do they last; are they brought

about by fluctuations in general physical fitness, disappointments, etc., or without any obvious cause. Frequent emotional upsets and changes from elation to depression and back again are cycles common to emotional individuals, and especially to those who are emotionally unstable and lack normal emotional control.

c. Breadth (habitual).—Emotional breadth is indicated by range and variety of objects which arouse one's emotions. A person who has a broad affective spread is one who reacts emotionally to a great variety of objects and situations. One who has a narrow spread responds to few things in an emotional manner. Is the subject easily aroused by the many changing objects and situations which surround us in everyday life; daily news items; misfortune of others; sentimental movies; is he easily moved to tears; are there any unusual fears, aversions, superstitions, pet peeves; do certain events or specific situations always seem to set off an emotional reaction. Number and range of these objects which arouse the individual emotionally serve as criteria of his emotional breadth. Perhaps one can even secure some information on this subject by inquiring as to the number of romances and type of person arousing this emotional reaction. To prefer a brunette today, a redhead next month, last year a blonde, shows greater emotional breadth than one who habitually chooses the same type.

d. Strength (habitual).—Strength of emotion refers to the intensity with which it is felt or displayed when aroused. Some people feel strongly one way or another about anything which arouses them at all. Others hardly ever become deeply aroused and show habitually only superficial emotional reactions. Profound, strong likes and dislikes, definiteness of opinions, and the seriousness of romances may be of some help in evaluating the strength. One with habitually weak emotions will likely be frivolous in his romances, forget his disappointments quickly, and in general will show a lower degree of response to various situations.

e. Appropriateness.—The relation of quality as well as quantity of the emotional response to the event arousing it is important; do the reactions seem appropriate and graded to the stimuli which have aroused them. Under *d* above it has been pointed out that individuals do vary in degree of response, but does this seem all out of keeping with what can be considered normal or expected under the circumstances. It may be difficult to determine what a normal response is, but individuals with great emotionality respond to events with a display out of all proportion to what should be expected. The other extreme will show practically no emotion or a shallowness of affect to situations which should bring forth a more

intense display. One will not expect to find applicants whose responses are so inappropriate that there is a complete indifference or qualitative alteration in the emotional response. The important thing is that individuals are desired who fall within normal range and suitability of those who manifest extremes of response should be questioned.

f. Control and stability.—(1) A viewpoint not so very different from some of those just discussed is the control over emotions, resulting in stability or instability. Many acts are committed while under the influence of emotion which would not have been considered if one had had full control of himself and of his emotions. Evidence of a lack of control may be manifest by frequent upsets, undue fluctuations, and particularly a tendency toward fits of anger and excitability. Is there any evidence of such a lack of control; how does the subject get along with people; frequent quarrels; numerous fights; easily upset to a state of panic or uncalled for excitement. Such manifestations of emotional activity may be due to other aspects of the emotionality of an individual but to some extent they also reflect the control which one has over this component of his make-up. Evidence of courageous or of cowardly behavior, if any can be elicited, may be of some help, for courageous behavior is controlling one's activity in the face of strong emotion, usually of fear or uncertainty. Cowardly behavior is usually simply acting according to dictates of emotion, meaning that the emotion has control rather than the individual.

(2) One part of the examination for flying applicants which is being given more and more importance as an index of emotional stability is the Schneider index. This was originally used as an index of general physical fitness, but since it is based to a considerable extent on changes in pulse rate and blood pressure, it is proving to be of considerable significance in judging emotional reactivity. The Schneider index should always be noted in making the final estimate on the emotional content. One who is easily disturbed emotionally and is upset by the examination will almost certainly make a poor showing on this test. Most significance should be put on the first examination, for after repeated attempts and familiarity with the test the emotional aspect is removed and a good score may be made. The first tests however reflect degree of reactivity and instability which is largely emotional in many instances.

(3) Other findings which are of definite help in evaluating emotional stability will be considered under somatic demands (par. 185). These include such factors as speech defects, nail-biting, thumb-

sucking, tics, mannerisms, insomnia, and pavor nocturnus, and each may be significant as evidence of emotional instability. Finally, one should decide whether the candidate's emotional content can be considered within normal and safe limits. The emotionally unstable and those who show marked extremes of mood and temperament should not be accepted. Experience has shown that these types invariably make poor risks.

185. Somatic demands.—*a. General.*—Under this heading is desired to investigate and determine extent to which various activities of a psychosomatic character lay claim to the time and energies of the individual. These activities if excessive may use up energy which would otherwise be available for use along more desirable channels. Some of these activities are simply releases of excessive nervous energy and are expressed in various uncontrolled manifestations, or strong, excessive urges, perhaps of an instinctual nature, may demand an undue proportion of an individual's energy. Even less distinct claims, as degree to which the individual is committed to comfort indulgence of one kind or another, should be considered in this connection. It is also important to estimate degree of control which one has over these demands. Many manifestations are evidences of either nervous or emotional instability, showing up particularly under conditions producing emotional stresses, and show a lack of control and of stability in the individual.

b. Nervous instability.—Nervous stability implies maintenance and continuity of consciousness as well as absence of fainting spells, automatisms, convulsions, deliria, absences, and other epileptic manifestations. Presence of any of these may be looked upon as evidence of nervous instability. A thorough search of the subject's life should be made in an effort to uncover such evidence which should be interpreted in accordance with (1) to (5) below. Army Regulations specifically state that existence of certain manifestations of nervous instability, somnambulism for instance, will be disqualifying in itself. Others, alone or in combination, should be duly weighed as evidence of instability of the nervous system.

(1) *Epilepsy.*—Any evidence of epilepsy is disqualifying. The history of any convulsions or fits should be viewed critically as possibly an epileptic seizure. While convulsions in childhood and even a tendency to develop deliria in minor illnesses may not be considered as epileptic equivalents, they are also to be looked upon as evidence of some instability of the nervous system.

(2) *Somnambulism.*—Somnambulism is definitely an automatic act and completely outside control of the individual. Any history of

this disqualifies on an original examination for flying, and is cause for grounding a flyer. A careful history of episodes should be secured if a diagnosis of somnambulism is considered.

(3) *Nocturnal enuresis*.—Nocturnal enuresis also is in the nature of an automatic act and if manifested in individuals beyond the age when control should normally be expected is to be looked upon as evidence of nervous instability. Any history of occasional nocturnal enuresis persisting after the age of five should be given consideration, and even isolated instances in adolescent or adult years should be looked upon as indicating some instability.

(4) *Migraine*.—Migraine headaches are suspected by some to be related to an epileptic make-up. Whether or not this is true, migraine and headaches of migraine type should be looked upon as indicative of instability and as disqualifying. In questioning about headaches, their frequency, duration, and severity should be considered. In suspected migraine, is there any family history of headaches; unilateral with gastro-intestinal or visual disturbances. An occasional, mild headache may be discounted, but headaches which put one to bed and cause absence from work or from school are of importance. Does there seem to be a tendency to develop a headache with every little disturbance, digestive upset, bright sun, heat.

(5) *Fainting*.—One who shows a tendency to fainting or to losing consciousness easily and repeatedly lacks nervous stability. A history of fainting without adequate cause is a cause for disqualifying an applicant on the original examination for flying. Adequate causes include severe pain as that which may accompany serious injury, when one is in a weakened condition, during an acute illness, or recovering from one. Almost all other causes are inadequate and should be considered evidence of instability. Fainting while sitting in church, in crowds on hot days, while standing in ranks, from having missed a meal, from seeing or having a Wassermann taken are examples of inadequate causes for fainting. Of course, these are everyday occurrences and will be expected of many individuals who are normal and average, but it should be recognized that any tendency to lose consciousness in a flyer may result in tragedy. A flyer should have better than average nervous stability. Methods of estimating this important aspect are not very satisfactory. One who has never given any evidence of a tendency to faint may still be a potential fainter when a situation arises to which he has never responded. Where evidence of nervous instability does exist, evaluation is on a much sounder basis. Closely related to fainting is the tendency to lose consciousness readily as a result of slight or minor trauma. Most football players

are knocked out at least once during their career but there are some who have a history of many such instances or of many knock-outs in boxing which may be of only a momentary nature but indicate a readiness to lose consciousness. Another aspect of unconsciousness that one must also consider is the duration. One or two periods of momentary unconsciousness adequately accounted for should probably be neglected. Prolonged periods which seem out of proportion to the injury or those lasting from a number of hours up to days should be interpreted as evidence of instability or of such severe injury that possibly permanent damage may have resulted.

c. Emotional instability.—Although this subject was discussed broadly under emotional content (par. 184), it was pointed out there that certain manifestations to be taken up under somatic demands would be of help in evaluating stability or instability of an individual. Manifestations which when present may be included as somatic demands and at the same time be indicative of emotional instability include stammering, nail-biting, tics, mannerisms, insomnia, and pavor nocturnus. These activities are definite energy users, usually in a wasteful and inadequate manner.

(1) *Speech defects.*—A definite history of stammering or stuttering disqualifies on an original examination. Presence of an episode of stammering upon entering school, changing schools, getting up to give a talk, etc., probably means that the child reacted in a somewhat inadequate manner to the new situation, the stammering being a response to emotional stresses. Continued studies place more and more emphasis on the emotional basis for such speech defects, and while at the present time they may not be manifest or are controlled, the very history points out that the individual has in his make-up some instability. They will often admit that in emotional excitement they stammer a little. There may be definite evidence of stuttering during the interview and the examiner should be on the lookout for any speech defect.

(2) *Nail biting, mannerisms, tics.*—Nail biting, mannerisms, and tics are manifestations of instability and especially the latter may represent some more serious, repressed, unsolved mental conflict. Such activities are usually exaggerated under any emotional stress when control is lost and excessive energy escapes through these outlets. Unusual movements, postures, grimacing, gestures, lip-biting, finger or knuckle sucking are all to be interpreted as similar somatic demands.

(3) *Sleep.*—The sleep disturbances such as difficulty in falling to sleep, insomnia, and pavor nocturnus are to be given careful consideration as possibly indicating anxiety trends. Insomnia which persists

and for which the subject has consulted a physician and resorted to sedatives should be disqualifying for an applicant and cause for grounding a flyer. Pavor nocturnus is considered a manifestation of anxiety, and should be duly weighed in connection with related factors suggesting instability. In diagnosing pavor nocturnus one should try to elicit a history of truly terrifying dreams, sufficient to waken the subject, or to cause such restlessness that he has to be wakened by others. Repeated occurrence of occupational dreams of a disturbing nature may be looked upon as a manifestation of anxiety and disturbing dreams of flying or of crashes in a flyer form the basis for grounding.

d. Sex life.—(1) Of the fields in which somatic demands are manifest, sex interests are often of great importance in variety and intensity. In considering an individual's sexual history, one is dealing with a fundamental biologic urge which in the present culture is frequently the source of conflict and faulty adaptation. Interest in sex life of the subject is simply to arrive at a conclusion as to whether or not this important drive is present, controlled, and manifest in a normal manner. If not normal, whether present to a diminished or excessive degree, uncontrolled, or manifested by abnormal or perverse means.

(2) Securing accurate information on this subject is often difficult or impossible, and at times one may only become suspicious of abnormality from admitted lack of interest in the opposite sex, from the nature of friends and associates, attitudes of disgust with the subject being discussed, or admitted persistence of the childish auto-erotic habit of masturbation into adult years. Here it is important to put questions in the accusative, assuming that the subject has experienced such urges and that some reactions to these urges have been made. It will be futile to inject questions pertaining to this more or less private subject early in an interview when the examiner is still a stranger and the subject will assume a withholding and resentful attitude. Later, if led up to in a tactful manner, one usually will be able to secure enough information to evaluate this demand as normal or abnormal.

(3) As a child, who the playmates were, mostly boys; both boys and girls; at what age did he become interested in girls so that he began having "dates", or hasn't he ever had a "date"; does he enjoy girls' company; do they enjoy his company as well as they do most boys; when in company of opposite sex is he natural and at ease, or the opposite; has he had his share of romances, that is, steady girls for weeks or months; ever been married; were there ever any great disappointments in breaking up with a girl; how he satisfies his sexual urges at the present time. Asking this in an accusative manner assumes that he has such urges and that they are satisfied in some manner. If

hesitant, suggest public house; girl friends. Perhaps any actual experience will be denied but occasional nocturnal emission will be admitted. Masturbation; when was the last time he masturbated; during what years did this habit persist; up to present; how often. Any of these methods of reaction indicate presence of a normal sexual urge and can be considered as normal reactions, although persistence of masturbation into adult years of life is to be looked upon as evidence of lack of control and instability or suggestive of sexual perversion.

(4) Atypical adult sexual adjustments hardly will be admitted. Frank satisfaction may have never been made due to such conditions as religious or home teaching, lack of opportunity, physical unattractiveness, etc. Undue interests in hobbies, work, children, boys' groups, pets, etc., with apparent lack of normal urge may suggest atypical adjustment. General behavior, mannerisms, or effeminate traits may suggest homo-sexuality. How the subject explains his lack of sexual urges (if that is the case). In summary, whether the urges and manner of satisfaction can be considered normal in degree and type; excessive or diminished to the extent that he is considered sexually abnormal.

e. Alcohol, tobacco, drugs.—(1) *Alcohol.*—Use of alcohol frequently, or to excess when used, may be a somatic demand resulting from conflict and providing temporary escape from the conflict. Excessive use may be just due to instability and lack of control and will-power in an individual. In any case, excessive use of alcohol disqualifies. Occasional use of alcoholic beverages socially and in moderation may be all right, but in applicants who are still young adults in their early twenties, frequent regular indulgence to the extent that they get "drunk" should suggest an apparent fondness for alcohol and should be given special consideration as evidence of instability or lack of control. In considering use of alcohol it is important to inquire about effects upon the individual. Alcohol may release a great variety of neuropathic manifestations which will vary in different individuals depending upon their latent personality components. Much of the acquired overlay of normal behavior may be the first to be affected by alcohol uncovering all sorts of more basic tendencies. Aggressiveness, tendency to fight, withdrawing to clam-like self-sufficiency, depression, elation, convulsions, and many other common types of behavior while under the influence of alcohol show up basic and latent tendencies in the individual.

(2) *Tobacco.*—It is difficult to say just how much tobacco must be consumed in order to say that an excessive demand exists. Certainly one who never stops smoking during a period of hours, lighting one

cigarette from the previous one, has an excessive demand. Such smoking is developed frequently in response to emotional stresses. In applicants for flying training it has become more or less arbitrarily established that up to one package of cigarettes a day (20 cigarettes) is not excessive. If more than this are regularly consumed, one should interpret it as excessive in a young individual.

(3) *Drugs*.—One should inquire as to quantities of drugs and medicines used and if any, reasons therefor. While a history of habitual use of drugs seldom will be admitted, even such things as very frequent use of aspirin for headaches, sedative for insomnia may be important for they indicate existence of conditions already discussed, and also indicate an undesirable somatic demand in use of drugs.

f. Valuation.—Finally, in evaluating the somatic demands of an individual, the number, variety, and degree of these demands should be considered and also degree of control applied to them. Even such things as eating and sleeping habits, indulgences such as daily candy bar, soft drink habit, etc., are in the nature of somatic demands where the subject demonstrates degree to which he gives in to these demands or over which he exercises control. All the reactions discussed under nervous instability, emotional instability, sex demands, alcohol, tobacco, drugs, as well as reactions to less definite demands are to be taken together in arriving at an estimation.

186. Sociality.—The subject of sociality is an important aspect of personality and an individual's behavior reactions depend upon it in many of life's situations, and especially in those where relationships with other human beings are concerned. Three viewpoints of this subject will be considered and one should attempt to evaluate each as pertaining to the candidate. These will be discussed as sociability, urge to adapt to the current social standard, and self-seeking tendencies, all of which are expressions of sociality and are manifest in relations to others.

a. Sociability.—This variable refers to that tendency which can be graded along the scale of gregariousness-solitariness. There are some people who can hardly bear to be alone and are definitely gregarious in that they desire to be with people and in groups. They are restless, dissatisfied, and actually unhappy if deprived of company. There are others who seek solitude, have a definite aversion to social groups, and are uncomfortable in the presence of other people. Whether the subject shows a strong desire for companionship, moderate desire, indifference, or avoids people and groups; what is the evidence that he is sociable; has he many acquaintances; close friends; makes friends easily; how much time he spends in company of others because he

wants to. This may be estimated by number of clubs of which he is a social member, extent to which he participates in group sports, size of his correspondence, enjoyment of parties and dancing, participation in civic affairs, church groups, etc.; from what activities he gets the greatest satisfaction; reading; solitary walking; hobbies indulged in alone, or from parties, group sports, visiting, and other activities with companions. Bashful or self-conscious; does he have difficulty in meeting strangers; does he like to be by himself; is he actually seclusive, eccentric, unsociable; how he gets along with people in general. Whether he gets enjoyment from being a member of a group with which he can identify himself, political, welfare, charity, or whether he seems to take satisfaction in being different from other people.

b. Urge to adapt.—For long continued smooth and frictionless social relationships, individuals must modify continuously their conduct to accord with interest and demands of the others as well as conform to cultural, moral, and civil standards which represent the society of which they are members. The degree to which this urge so to conform is present varies greatly in individuals and is generally expressed by their appreciation of rights of others, by courtesy, sympathy, generosity, and general cooperativeness. Does the subject have a good general regard for the rights and feelings of others; anything in his history which suggests a lack of appreciation of what is right and wrong; any cheatings; taking unfair advantage; breaking laws; destroying or stealing property; ever been arrested; what for; any disciplinary actions taken against him at home, at school, or by civil authorities. In games, whether he shows good sportsmanship with fair play essential. Whether he conforms to customs of courtesy, appropriateness of dress, modesty, cleanliness, speech, morality, etc., of his environment; what the reaction is to approval or criticism by his fellow men; encouragement, resentment, correction of faults, rationalization, indifference. As a result of the molding influence of society, has this "socialization of behavior" been adequate, inadequate, or excessive. There are some who seem to have so much of this urge to adapt that they are afraid to do anything for fear of hurting someone or for fear of disapproval, and all their acts are characterized by hesitancy, absolute conformity to rules, and lack of aggressiveness. To find themselves violating a "keep off the grass" sign pricks their conscience with a sense of guilt. Has reaction to demands of society been of a rebellious or nonrebellious nature?

c. Self-seeking tendencies.—Another aspect, perhaps closely related to ambition which has already been discussed in paragraph

167e, is that of self-seeking tendencies manifested by aggressiveness and acts which intensify sense of importance, possession, and accomplishment for the individual.

(1) In relationships with other people, whether he tends to take the lead or to follow; does he desire responsibility; is he aggressive, self-assertive, and wants to do things first; or submissive and passive; a leader; a follower. What his tendency has been in this respect throughout his history, in school, in games, in his work life, and in his home. Whether he is positive in his assertions and often gives advice, or depends on others to make the decisions. Excellence in performance in various activities of a cultural nature increases this sense of importance and frequently accounts for urges to excel in such things as music, athletic accomplishment, dramatics, etc.

(2) Unsocialized conduct springs from the original and unmodified self-seeking of human nature. Extreme selfishness untempered by restrictions of society at times leads to seeking one's own ways at the expense of the interests of others, and accounts for criminal behavior of a completely antisocial nature. The basic selfishness of the delinquent is recognized by all who deal with him.

d. Valuation.—How the subject is to be evaluated as to his sociality, considering all three of the viewpoints discussed? Active participation in social events with an eagerness to obey rules, respect the rights of others, and general cooperativeness is of course desirable. Leadership is always a desirable quality, and aggressive self-assured behavior, if controlled and guided by a desire for social good and by unselfishness, is a favorable type.

187. Philosophy of life.—The final consideration in this study of personality is to secure some information about the guiding principles by which the individual lives. Probably very few if any of the applicants for flying training will have arrived at a stage sufficiently mature to have developed a final and personal philosophy of life in the sense that they place themselves in some particular niche in the scheme of things, with some definite cause or ideal governing the major portion of their life's activities. However, as the result of environmental conditionings through formative years certain systems of beliefs are built up in many, and these become personal ideals and do act as guiding principles in relationships with others. Does the subject have any such principles; what they are; broad; narrow; idealistic. A common one, no doubt, varying in concept from one individual to another, but which on the whole is satisfactory is "The Golden Rule." Others are less definite and there will be many who have never given a thought to such serious things as guiding

principles. All this is to be taken into consideration in final evaluation of the individual. Where definite systems of beliefs do exist, are they held as strong convictions; or weak ones; have they been modified or changed, or ideals shattered; with what result on the individual.

188. Summary.—*a.* It is not to be expected that any one applicant will possess all good qualities to exclusion of all poor ones. It will be necessary to weigh the favorable against the unfavorable and a preponderance of one or the other will lead to an estimate of satisfactory or unsatisfactory. Conditions which in themselves are absolutely disqualifying will be searched for carefully. Personality trends, if present to a considerable degree, which suggest a psychopathic constitution and should be disqualifying are seclusive, overactive, depressive, unstable, suspicious, egotistical, irritable, sexually abnormal, and criminalistic.

b. Following the Form for Case Study (par. 1, app. I) a list of descriptive terms and trait names is presented as an aid in formulating a summary and description of the applicant based on the personality study made of him. In using the outline (app. I) for a personality study frequent reference should be made to the discussion in this section whenever questions arise as to technique, procedure, and method of scoring.

APPENDIX I

OUTLINE FOR FLYING ADAPTABILITY RATING

1. Form for case study.

Name_____

1. FAMILY HISTORY.—*Value, 5.*

a. Father:

Age_____Died at age_____Cause of death_____

Serious illnesses_____

Education_____Occupation_____Success_____

Civic and social activities_____

Characteristics (personality)_____

b. Mother:

Age_____Died at age_____Cause of death_____

Serious illnesses_____

Education_____Occupation_____Success_____

Civic and social activities_____

Characteristics (personality)_____

c. Siblings:

Brothers: Living_____Dead_____Cause of death_____

Sisters: Living_____Dead_____Cause of death_____

Differences (personality)_____

d. Parent-child relationship (comradeship)_____

e. Eccentricities (familial)_____

f. Adjustment difficulties (familial)_____

Score_____

2. ENVIRONMENT.—*Value, 5.*

Reared by_____Where_____Population_____

Birth order_____child. Broken home_____Economic

conditions_____

Discipline_____Solicitude_____

Ethical principles emphasized_____

Home conflicts: Parents_____Others_____

Reaction (opinion) to home training_____

Score_____

3. MORPHOLOGY.—*Value, 10.*

Graceful_____Awkward_____

Symmetrical_____Asymmetrical_____

Strong points_____Weak points_____

Score_____

4. INTELLIGENCE.—*Value, 60.**a. Education:*

Grammar school: Name_____ Years_____ Class standing____

Failures_____

High school: Name_____ Years_____ Class standing____

Failures_____

Graduate_____ Age_____

Colleges: Name { _____ Years_____

{ _____ Years_____

{ _____ Years_____

Class standing_____ Degree_____ Age_____

Deficiencies, academic:

Conditions _____

Failures _____

Reasons _____

Reactions to _____

Education continuous_____ Why not? _____

Easiest subject_____ Hardest _____

Expense, how met _____

Extra-curricular activities { _____

Education up to opportunities _____

Course, reason for _____

Scholastic standing, result of { Application _____
Ease of acquirement _____*b. Learning:*

Capacity, mental_____ Motor _____

Rate, mental_____ Motor _____

Inquisitiveness _____

c. Memory: Logical_____ Illogical _____*d. Imagination (vision)* _____ Fantastic _____ Practical _____*e. Attention:*

Span _____ Control _____

Attentive _____ Inattentive _____

Mental inertia excessive _____ Good control _____

Sympathetic response to speaker__ Expressionless attitude____

f. Perception: Identification of objects:

Quick _____ Slow _____

Accurate _____ Inaccurate _____

g. Comprehension: Clearness of ideas _____

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h. Judgment:

Quick	Slow
Impulsive	Deliberate
Decisive	Indecisive
Rational	Irrational
Mature	Immature
Finance well handled	Poorly handled
Foresight	Problem solving
Soundness	

i. Tact: Tactful Tactless

j. General adaptibility
Score

5. ACHIEVEMENT.—*Value, 20.**a.* Goal (ambition):

Vocation selected early	Late	Present
Choice definite	Indefinite	
Reason for choice, sound	Unsound	
Factors influencing decision, logical	Illogical	

b. Drives.

Major	Minor
Definite	Indefinite
Organized	Unorganized
Coordinated	Incoordinated
Sustained	Unsustained
Efforts focalized	Unfocalized

c. Conflicts:

Major	Minor
Many	Few

d. Thwartings: Adjustments, faulty Favorable

e. Compensations:

In kind	Vicarious
Logical	Illogical
Adequate	Inadequate

f. Accomplishments: Satisfying Unsatisfying

g. Opportunities: Advantage of

h. Self-evaluation:

(1) Insight:

(a) Viewpoint adopted:

Objective	Subjective
Sublimation	Rationalization
	Projection

(b) Degree into:

Motives _____

Limitations _____

Driving forces _____

(2) Inventory:

(a) Favorable qualities {

(b) Unfavorable qualities {

i. Mental stability _____

Score _____

6. PSYCHOMOTOR ACTIVITY—*Value, 20.*

a. Motility:

General activity level: High _____ Low _____ Quick _____
Slow _____

Energetic _____ Inert _____

Impulsive _____ Steady _____

Efforts well directed _____ Poorly directed _____

Evidence of impulsion _____ Evidence of inhibition _____

Skills and aptitudes _____

Style (individuality) _____

b. Disposition of time:

(1) Vocational:

Well planned _____ Poorly planned _____

Efforts, persistent _____ Nonpersistent _____

Accomplishment, adequate _____ Inadequate _____

(2) Avocational:

Athletics _____ Hunting _____

Fishing _____ Social _____ Hobbies _____

Time factors well balanced _____

Score _____

7. EMOTIONALITY.—*Value, 35.*

a. Patterns of expression:

Phlegmatic _____ Choleric _____

Enthusiasm present _____ Sustained _____ Lacking _____

Imaginative _____ Unimaginative _____

Colorful _____ Colorless _____

Plodder _____ Enlivened _____

Potential: High _____ Low _____

Self-confidence, adequate _____ Inadequate _____

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- Level (habitual) -----
 Poise present ----- Absent -----
- b. Breadth (habitual) :
 Range, response to things: Many ----- Few -----
 Romances, many ----- Few -----
 Unusual fears ----- Aversions -----
 Loaded stimuli -----
- c. Strength (habitual) :
 People, profound likes ----- Dislikes -----
 Romances, serious ----- Frivolous -----
 Objects: Profound likes ----- Dislikes -----
 Reactions graded to stimuli -----
- d. Attitudes (habitual) :
 Reactions appropriate to stimuli -----
 Upsets: Frequent ----- Infrequent -----
 Anger: Controlled ----- Uncontrolled -----
 Excitement: Controlled ----- Uncontrolled -----
 Disappointments: Controlled ----- Uncontrolled -----
 Courageous ----- Cowardly -----
 Sensitive ----- Insensitive -----
 Evidence of Repression: Present ----- Absent -----
 Tense ----- Relaxed -----
- e. Stability (emotional) -----
 Score -----
8. SOMATIC DEMANDS.—*Value, 25.*
- a. Nervous instability :
 Reaction to illness (convulsion, deleria) -----
 Circumstances -----
 Frequency -----
 Somnambulism ----- Frequency -----
 Circumstances -----
 Nocturnal enuresis prolonged to ----- years of age
 Headaches (migraine type) -----
 Loss of consciousness ----- Frequency -----
 Circumstances -----
- b. Emotional instability :
 Speech defect ----- Type ----- Degree -----
 Circumstances ----- Age corrected -----
 Nail-biting ----- Degree ----- Age corrected -----
 Circumstances -----
 Tics -----

Miscellaneous symbolic or nervous movements -----

Insomnia -----

Pavor Nocturnus ----- Frequency -----

Circumstances -----

c. Sex life:

Urges: Strong ----- Weak ----- Unbalanced -----

Attitude in harmony with sex -----

d. Alcohol ----- Tobacco ----- Drugs -----

e. General discipline: Strict ----- Lax -----

Score -----

9. SOCIALITY.—*Value, 15.*

a. Social Participation:

(1) Companionships:

Strong desire ----- Moderate -----

Indifferent ----- Avoids -----

(2) Friendships:

Close ----- Casual -----

Ability to make -----

Ability to keep -----

(3) Cultural interests:

Dancing ----- Music -----

Clubs ----- Fraternities -----

Sports -----

Strong desire ----- Moderate -----

Indifferent ----- Avoids -----

(4) Introvert ----- Ambivert ----- Extrovert -----

b. Urge to adapt.

(1) Susceptibility to social stimulation: Reaction to:

Praise ----- Social approval -----

Social disapproval ----- Criticism -----

Punishment -----

Rules ----- Competition -----

(2) Molding influence of society: Adequate ----- Inadequate -----

Excessive -----

(3) Reaction to the shaping process: Rebellious ----- Non-Rebellious -----

c. Self-seeking tendencies:

Aggressive egoism -----

Ascendence ----- Submission -----

Score -----

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10. PHILOSOPHY OF LIFE.—*Value, 5.*

- a. System of beliefs: Narrow ----- Broad ----- Idealistic -----
 b. Modification: Yielding ----- Unyielding -----
 c. Convictions: Strong ----- Weak -----
Score -----

Recapitulation

	Value	Score
1. Family -----	5	-----
2. Environment -----	5	-----
3. Morphology -----	10	-----
4. Intelligence -----	60	-----
5. Achievement -----	20	-----
6. Psychomotor activity -----	20	-----
7. Emotionality -----	35	-----
8. Somatic demands -----	25	-----
9. Sociality -----	15	-----
10. Philosophy of life -----	5	-----
Total -----	200	-----

A score of 160 or over is considered satisfactory.

2. Descriptive terms and trait names.

Physical appearance

Prepossessing	Inferior	Graceful	Odd
Impressive	Undeveloped	Awkward	Neat
Ordinary	Weak	Plain	Unkempt
Unimpressive	Asthenic	Vigorous	
Insignificant	Athletic	Effeminate	

Manner

Pleasant	Colorful	Aloof	Careful
Frank	Colorless	Argumentative	Careless
Evasive	Serious	Obstrusive	Conscientious
Embarrassed	Frivolous	Belligerent	Critical
Shy	Precise	Suspicious	Easy-going
Resentful	Vague	Coarse	
Suspicious	Conservative	Tough	
Calm	Brusque	Casual	

MEDICAL DEPARTMENT

Intellectual activities

Keen	Capable	Distractible	Inquisitive
Sharp	Limited	Logical	Uneducated
Intelligent	Questionable	Illogical	Tactful
Average	Superficial	Imaginative	Tactless
Mediocre	Penetrating	Unimaginative	Mature
Dull	Alert	Resourceful	Immature
Stupid	Inattentive	Resourceless	

Psychomotor activity

Overactive	Quick	Dynamic	Controlled
Bustling	Slow	Forceful	Uncontrolled
Rushing	Impulsive	Energetic	Trained
Restless	Hasty	Enthusiastic	Untrained
Active	Deliberate	Listless	Tenacious
Sluggish	Hesitant	Decisive	Persistent
Lethargic	Methodical	Uncertain	Yielding

Achievement

Efficient	Noneffective	Erratic	Unreliable
Inefficient	Adequate	Variable	
Effective	Inadequate	Dependable	

Emotionality

Emotional	Phlegmatic	Apprehensive	Hot-headed
Choleric	Apathetic	Satisfied	Tense
Moody	Elated	Dissatisfied	Relaxed
Excitable	Cheerful	Discouraged	Stable
Undemonstrative	Depressed	Irritable	Unstable
Placid	Anxious	Uneasy	

Sociality

Sociable	Seclusive	Uncooperative	Dominant
Congenial	Extrovert	Dependent	Self-reliant
Reserved	Introvert	Egotistical	Self-depreciative
Unsociable	Leader	Sensitive	Pacific
Solitary	Follower	Selfish	Submissive
Expansive	Cooperative	Aggressive	

APPENDIX II

ILLUSTRATIVE CASE HISTORIES

The following case histories are presented in order to emphasize importance of painstaking investigation and need of understanding psychiatric values of all factors and manifestations.

1. **Lieutenant X.**—A personality study in the case of Lieutenant X was made at the School of Aviation Medicine in March, 1924, and the history given below was obtained. Since 1918, various flight surgeons had made, in form, similar studies of this pilot without discovering the facts as here stated, at least without causing action other than that in April, 1923, when he was made an observer. Certainly none of the information, if elicited, was ever forwarded to the Chief, Medical Section, Air Service. Comment seems unnecessary.

History.—Lieutenant X had his training in 1918. One day in 1920, while at about 10,000 feet, his head was turned sharply to the right as he studied the landscape beneath, this for perhaps 30 or 40 seconds. On sitting erect and facing forward there was blurring of vision with black specks, and immediate fear of fainting, although he does not believe he actually fainted. In a panic he shouted to the observer to place his stick and dived about 2,000 feet. He believes the downward rush cleared his head and he circled about, but again had feeling of fainting and landed at once. He reported the occurrence to the flight surgeon and says he continued to fly but ever afterward was fearful of fainting. In April, 1923, while on cross-country, again had fainting feeling, returned to his station, reported to the flight surgeon, and was made an observer. Says has no fear of fainting since being an observer, but is averse to ever taking the stick again.

When about 8 years old he fell about 15 feet, striking his head on the pavement, had concussion, and was unconscious about 4 days. Between his 9th and 15th years he fainted in his seat in church on at least three occasions. During his training period in 1918, having had 10 hours in the air, he was practicing hopping a tree on the border of the field, struck the treetop, and had a complete "wash-out." He climbed out of the wreckage, lit a cigarette, conversed with the bystanders, and then walked to the ambulance and was

taken to the hospital to have his wounds dressed. He explained he was told he did these things, but has no recollection whatever of what occurred. There is complete amnesia for a period of about $\frac{1}{2}$ hour. He recalls seeing the treetop and then of being in the hospital. Significantly, the disturbing thought ever afterward was, "Did I check speed so much that the ship dropped, or did I faint; the latter especially in view of my fainting record?"

Extracts from a communication of April 17, 1923, from the Chief, Medical Section, Air Service, to all flight surgeons: "Recently at the School of Aviation Medicine, a flier who had been examined elsewhere a number of times was shown to be at least a potential epileptic and probably a true epileptic. This man gave a history of enuresis up until 9 years of age, of stammering from 9 to 12 years, of somnambulism from 12 to 15 years, migraine with an attack of hemianopia from 15 to 20 years of age. When about 20 in getting out of bed he fell and struck on his head and remembered nothing until about 2 hours later when he said he felt sore all over. It is evident that the examination made at the school is the first careful neuropsychic examination this officer has ever had, else this condition could not have gone so long unrecognized. Flight surgeons are cautioned to make this examination with extreme care and thoroughness."

2. Captain Z.—One day at Mitchel Field Captain Z, an experienced pilot, was going into the air as a passenger. He had just returned from sick leave and had not yet been given the special (then) "609" examination required to be given in all such cases before the pilot is authorized to fly a ship. Presumably it occurred to Captain Z that he might during the ride have opportunity to take control. In any event, he obtained a stick and placed it in position in the rear cockpit. The pilot took off and when a few feet up found he could not move the stick the required distance. The ship crashed and the pilot sustained a fractured jaw. Captain Z was not injured. On inspection it was found that the stick the latter had placed was in reverse position, thus accounting for the fact that the pilot could not move his stick as required. Immediately Captain Z fell under the presumption of having been guilty of gross carelessness, but the possibility of some abnormal condition having arisen being conceded, he was sent to the school for examination. The history below was obtained.

History.—After the World War Captain Z was ordered from Langley Field to service in Germany. About 1 month after arrival there he was in the air as a passenger when the pilot crashed. Captain Z sustained a severe head trauma. had concussion, and was in

hospital a long time. Nearly a year later he was ordered to Walter Reed General Hospital for observation and treatment. There was amnesia reaching back to his departure 1 year before from Langley Field and down to the latter part of his return voyage. He recalled his departure from Langley Field but could not tell how he reached Germany. He could partly describe the pilot with whom he rode to the crash but could not recall his name. In addition he could tell of a few widely separated incidents connected with the period in Germany: that is, there were islets of memory. He could not however recall his departure from Germany, the continental journey, or the port from which he sailed. Memory began to return when about halfway across the ocean, became more and more clear, and was fully restored by the time he reached Walter Reed. After some time in this hospital he was declared fit for duty and reported at Mitchel Field.

Captain Z had been at Mitchel Field nearly 1 month and the flight surgeon knew, as is expected he should, that the captain had come to be regarded as an inefficient officer. During the examination the captain said he had believed himself fully recovered when he left Walter Reed but wondered in view of his experiences since whether the assumption had been warranted. He remarked that his work had been easy, yet he frequently felt excessively fatigued without adequate cause. For instance, while sitting at his desk of a morning there would be such weariness that regardless of what the situation might be, he would feel compelled to go to his quarters and lie down for a half hour or more. The examination now proceeded along more definitely psychiatric lines and an anxiety neurosis trend was clearly revealed. The special manifestations were frequent and terrifying dreams of occupational type, that is, of air accidents; apprehension concerning flying duty as well as any other duty; memory defects; irritability; inability to concentrate; tics; tremors; relaxed peripheral circulation; lowered psychomotor tension; and feelings of self-depreciation and insufficiency expressing an inferiority complex completely unsublimated, no effort at compensation, a defeated psyche. In view of the prolonged amnesia from which he had so recently emerged and the tragic error in placing the rear seat stick, there was need of establishing presence or absence or recurring minor equivalents in the form of the obtrusive memory lapses or automatisms. In these directions it was clearly shown that the captain at various times since being at Mitchel Field had found himself sitting at his desk or standing some place and wondering how long he had been there. These manifestations were interpreted as lapses of memory, momentary or longer, and the

condition or state obtaining at the time of misplacing the stick a disturbance in consciousness analogous in kind.

Captain Z was returned to Walter Reed General Hospital and after a period of observation was discharged on disability.

3. Flying Cadet X.—Flying Cadet X, age 21. Original examination, January, 1927. Reexamination at the School of Aviation Medicine, March 17, 1927.

History.—a. Family.—(1) The oldest child in a family of three; two brothers living and well. Father age 74, living and well. He is seclusive in type, strong willed and domineering. Mother age 53, living and well. She takes little interest in social or civic functions.

(2) *Environment.*—Parents were financially well off. His home life was not very happy because he was tied down, and his father assumed a peculiar attitude toward him and favored the other children.

(3) *Attitude toward flying.*—Violently opposed.

b. Personal.—(1) He was a healthy baby; no delay in development; no serious illness or injuries. Says he is a "Mother's boy" and has been more or less sheltered all his life. Was never allowed to develop as most boys, he was even timed going to and from school. Has always been a poor mixer and was teased a great deal. Had few or practically no fights; explains this by saying his parents forbade him to fight. His hobbies have been along the mechanical line; has cared little for social functions due he says to his parents holding him down and never permitting him to go out. Uses no alcohol or tobacco. He bit his finger nails up to the age of 17; has had a strong interest in sexual matters, but gives the usual history in development. Denies heterosexual relations. He has not been popular with the girls, and has had very few boyish romances. Claims it disgusts him to see fellows play around with girls like they do. In most things he has had to play the minor role.

(2) *Education and vocations.*—Progress in grammar school normal, but required $4\frac{1}{2}$ years to complete high school. At 19 he entered college taking an engineering course and went for $1\frac{1}{2}$ years. Claims he did not return to college because he wanted to look over the engineering field. He worked for 4 months with a surveying crew, next worked as a lineman for a telephone company for 2 months, and then enlisted as a cadet and reported for flying training.

(3) *Scholastic activities.*—In high school had military training; in college belonged to the Independent Men's Club. Not active in athletics.

(4) *Disciplinary record.*—Resentful of all criticism and punishment.

(5) *Ambition.*—He has always been interested in the service, and

took the examination for the Naval Academy. He claims to have made the highest grade in the examination, but was placed third on the list. He next tried West Point with the same result. He is suspicious of this whole transaction and believes there was some underhand influence used to prevent him from getting the appointment and he mentions his father as possibly the one who did it. After failing in his attempts to get into the academies, he next became interested in C. M. T. C. and R. O. T. C. work in order to get a commission in the reserve and to be better prepared for the emergency of war. He is very restless and has never been satisfied with anything. Now he hopes to complete his flying training and wear his "wings," and also to get as much military and engineering experience as possible. He has nothing definite as to his future, but thinks he will go into the reserve.

(6) *Temperament*.—Cheerful, frivolous, somewhat elated, unstable, and not aggressive.

(7) *Intelligence*.—Vague, superficial, unready, without initiative, only partially trained.

(8) *Volition*.—Energetic, impulsive, restless, yielding, quick.

c. *Summary*.—Emotionally unstable, mildly elated, rationalizes all situations, circumstantiality bordering on abnormal, marked paranoid tendency.

Psychologically unfit.

d. On the semiannual examination of July 2, 1927, the following notation appears:

Dreams, occupational in type relating to flying and crashes.

Temperament, highly nervous and apprehensive.

History: States that for the past six weeks he has noticed occasional attacks of dizziness upon rapid change of posture. Upon rising suddenly from recumbent to sitting posture suddenly "goes black or hazy." "Sense of balance" seems to go. Has had daily headaches lasting from five minutes to several hours. No recent constipation. Finger nails are bitten into sensitive zones.

Recommend he be temporarily disqualified for flying.

After being removed from a flying status, request was made for relief from drill because of frequent headaches and attacks of dizziness.

Following consultation with the flying department, it was decided to bring this cadet before the faculty board for final disposition.

Medical testimony before the faculty board pertaining to this case in substance, was as follows:

Flying Cadet X is very unstable, his judgment is defective, he is highly impulsive, and exercises volitional control with difficulty.

His adjustments are very faulty and his existence rendered unhappy thereby. As a result of his difficulties and constant fear and belief that he may be eliminated, in order to excuse himself and save his face he has developed what he describes as dizziness while doing acrobatic maneuvers. Since being relieved from flying he has in keeping with the usual neurasthenic carried his defense even further than is absolutely necessary, and now has reached the stage where he is unable to drill and has requested relief from it.

Board findings.—The board recommends: That he be relieved from further flying training and discharged from the military service.

During an interview with the commander of cadets following his discharge the cadet made the following statement:

"The whole cadet corps has completely ostracized me and there has been no one whom I could go to for a discussion of my various troubles and difficulties. It has always been hard for me to make friends. Soon after reporting here I was caught in a compromising act, and following this, I was subjected to constant taunts and insults by members of the corps. These insults I resented very much, but I have never had the nerve to define myself; it is not that I am afraid of personal injury in combat, but it seems I am afraid of losing self-control, and doing serious injury to my opponent. I have been knocked and cuffed about and invariably my reaction has been to lie down on the floor and cry. I stood it all as long as possible and finally gave up and told the doctor I was having dizzy spells. I was not suffering from headache and have not been dizzy except one time while doing a barrel roll, and that was for only a fleeting instant."

4. *Flying Cadet B.*—Flying Cadet B, age 24. Original examination January 12, 1926. Reexamination March 14, 1927.

History.—*a. Family.*—Youngest in a family of three; two sisters living and well. Father living and well at the age of 64; not a good mixer; has a quick temper; undertalkative. Mother living and well at the age of 68; inclined to stay at home.

b. Personal.—(1) Has had no serious illness; had one motor accident and was unconscious for a few minutes; good recovery with no after effects. Has been slow in making friends; was teased a great deal; has a rather violent temper. Hobbies were of a mechanical nature, including radio and airplanes. Uses no tobacco and little alcohol. He is very susceptible to the effects of alcohol. Thumb sucking and nocturnal enuresis up to 12; bites finger nails at present; gives usual history of sex development with some inclination to worry over his habits. He is very self-conscious in crowds; has had

few romances and never got along well with girls. Disappointments affect him keenly. Has a vivid imagination along impractical lines.

(2) *Education*.—Failed one subject in grammar school. Entered high school at 14, and dropped out after 2 years because of his many failures. Was able to get only two credits for a full second year in high school. He was out of school for a few months but then returned and completed high school without another break. He then enlisted as a cadet and reported for flying training in July, 1923. Although he had difficulty in his academic work at the primary training field, he was able to graduate with his class. He reported for advanced training and was eliminated after 3 months for failure in academic work. After his discharge he purchased an airplane and did barnstorm flying for 4 months. He sold his plane and entered the University of Illinois, taking subjects leading to college entrance; attended there for one semester, and then changed to the University of Missouri, taking an arts and science course; attended for 3 months and then dropped out.

(3) *Ambition*.—To become an Army officer.

(4) *Environment*.—Happy home life. His people able to send him to college.

(5) *Disciplinary record*.—Resentful of punishment and says it was of no value.

(6) *Temperament*.—Cheerful; unstable; tense; self-depreciative; not aggressive; modest; frank; likes to be alone; careless; serious; good cooperation.

(7) *Intelligence*.—Precise; superficial; dull; alert; deliberate; without initiative; untrained.

(8) *Volition*.—Not energetic; slow; impulsive; restless; withholding.

c. *Impression*.—Emotionally unstable; slow learning rate; no definite goal in life; untrained.

Psychologically unfit.

d. On the semiannual examination of July 7, 1927, the following notation appears:

"Much depressed, and complains of periodic headaches for past two months. Is anxious to get a furlough and be held over until the next class. Has had an extensive sick call record for past two months."

Repeated examinations both at the school and at the hospital fail to locate any pathology. Physical efficiency test normal.

Recommend he be temporarily disqualified for flying.

Following consultation with the flying department, it was decided to bring this cadet before the faculty board for final disposition.

The facts presented to the board which are of interest from a medical viewpoint are in substance as follows:

This cadet due to a low mental endowment has not been able to reach the level of performance maintained at these training schools except by excessive hard work and application. This has been done at the sacrifice of his mental and physical well-being. As a result he has developed, consciously or unconsciously, a persistent headache, which is believed to be a defense reaction or a way out of the unfortunate situation in which he finds himself. Believing he has these headaches, and actually suffering therefrom, it is to him a legitimate reason for requesting a furlough in order to escape.

Anyone who does not want to fly should not fly. He has reached the stage where he wants to rest. If he gets a furlough, he may return and be able to complete this course. He was eliminated at the Advanced Training School in 1924 on academic work, and probably his major difficulty is in that work at the present time.

The Director of Ground School testified that he came to see him to find out if there was any way he could postpone his examinations, and discussed the possibilities of getting a furlough and being held over until the next class.

The records show that he is taking practically the same work in the academic department as he had 3 years ago, and yet he has already failed in one subject and is deficient in others.

He graduated at the Primary Training School in March, 1924, and went to the Advanced School for three months and was then eliminated for deficiency in academic work.

He complains of feeling tired all the time and says it is an effort for him to begin flying each morning. Stunting upsets him badly, and dual instructions get on his nerves.

Board findings: That he be relieved from further flying training and discharged from the military service.

5. Flying Cadet C.—Flying Cadet C, age 23. Original examination, June, 1926. Reexamination, February 28, 1927.

History.—*a. Family.*—An only child. Mother living and well at 43 years of age; she has keen executive ability; a good mixer; likes sports, etc. She was an American girl, the daughter of a comfortable New England family. Father living at 52, and he thinks is well; he is the son of a long line of British Army officers, and his father has taken an active part in all the wars of his time. At the end of the Boer War he came to this country to look into some mining property,

and met at that time the woman who later became his wife. In the World War he reached the grade of colonel of Infantry. He received a head injury, and he thinks as a result of this, had "shell shock." His father always drank but never to excess, a good mixer, able to adapt himself to any and all situations and people. His father's family more or less cast him out when he married an American girl.

b. Personal.—(1) Was born in Quebec; it was a difficult labor; he was a healthy baby; had no knowledge of time of walking or talking; no serious sicknesses or injuries. He played with boys; at 6 he was shy and timid, but after this he rather found himself, and made friends quickly; and it was easy for him to adapt himself to new groups. In early life he was teased a great deal, but he soon learned to disregard this. He has not a quick temper. Had the average number of fights; employed his fists; usually got defeated. He did not like to fight, but was never inclined to allow anyone to run over him; he felt no concern for personal safety in combat. His performance suffers under anger.

(2) *Somatic demands.*—His hobbies have been radio transmission and drawing. He is overtalkative. Prefers people. He reads books on travel, imaginative fiction, and biographies. Has a rather vivid and fertile imagination. Smokes four cigarettes daily. Has consumed a small amount of alcohol; has an average capacity; the effects are not particularly pleasing; there is no elation. He bit finger nails up until 10. He has a speech defect which he has had all of his life. He claims that it gets no worse under excitement which is doubted. Masturbation began at the age of 8 or 9, continued to the age of 16; was not easy to discontinue. First heterosexual contact at 17, a girl 3 years his senior; she was the aggressor. He has had only about three experiences. First interest in girls at the age of 17, has not had any romances, the longest time he ever went with one girl was 6 months; has never been in love. He has never given any thought to double standards of living. He never considered matrimony. He likes social functions if not too formal; prefers dinner parties. Prefers girls he already knows to strangers, although he feels free and easy among strangers. He has been forced to play the minor role in many things, but has managed to compensate for this through his radio efficiency. He has been more or less accepted by girls but never considered himself a favorite.

(3) *Education.*—Grammar at 6, finished at 14, stood in the upper third; prep school at 15, finished at 19, middle third, his grades were low in Latin in high school. He had frequent changes in prep school for various reasons. After completing prep school he accepted

a job as a miner in Arizona; he had not the strength to continue that work, so he was given a job as a crew foreman. He returned East shortly after this, and entered Cornell University at 20, taking an electrical engineering course. He went to Cornell for 1 year; got along badly, failed two subjects and "busted out," or failed to be promoted. He then went to work for a lumber company in Quebec; worked there for 6 weeks. He returned, entered New York University, taking an industrial engineering course. He continued in this university for a year and a half. At first he had difficulty with his grades, but later they improved. He transferred from the industrial engineering course to a course in aeronautics (Guggenheim) at New York University where he went for one term. He got along well in his work. It would have required 1 year longer for him to have completed this course; he dropped out due to lack of finances.

(4) *School activities*.—Member radio club; history club; contributor to literary magazine.

(5) *Athletics*.—He made no teams. Is a good swimmer; he tried diving at 25, with no success. Has no musical talent. Is a fair dancer. Is a good horseman; and feels that he has a keen sense of rhythm.

(6) *Learning*.—Rate, mental, average; motor, above average. Capacity, mental, average; motor, above average. Memory, average. Attention, interests are quickly aroused, but soon lost. He does not have good control over attention. Application, has been average.

(7) *Environment*.—He was placed in a boarding school at 6, and has spent practically all of his life in boarding schools and summer camps. His father and mother were separated. He knows nothing of home life, and knows little about their marital relations or troubles. His mother has helped him some in his attempts to obtain an education, but for the most part he has had to depend upon his own resources.

(8) *Attitude of family*.—Favorable.

(9) *Disciplinary record*.—He received a great deal of physical punishment which he feels did not help him. He does not care for praise.

(10) *Ambition*.—Has always wanted to be an aviator; he definitely decided on this at the age of 19; since then he has devoted a great deal of his time to aeronautical subjects. He now would like to be an Army officer. He is particularly interested in the radio end of aeronautics.

(11) *Self-estimate*.—Favorable. His outstanding quality is the ability to manage people. He is handicapped by excessive talking and impulsiveness.

(12) *Temperament*.—Cheerful; unstable; moderately aggressive; frank; fond of people; good cooperation; moderately relaxed.

(13) *Intelligence*.—Precise; penetrating; alert; resourceful.

(14) *Volition*.—Energetic; quick; impulsive; fair tenacity.

(15) *Stigmata*.—Large right ear.

c. Impression.—Extrovert; unstable; has had difficulty in his adaptation to many situations in life; he is emotionally unstable; there is some evidence of pressure activity. He has a keen intelligence. His volition is favorable. He is a borderline case, but it is thought that his instability is too much of a handicap. Psychologically unfit.

d. This student was permitted to begin regular training with his class and continued training until he had accumulated 7 hours and 10 minutes flying time. At this time he was brought before the faculty board and eliminated as a result of "failure to make satisfactory progress in flying training." The following adverse comments were made by the various instructors on his flying technique: Poor judgment; reacts slowly; thinks slowly; lacks coordination; lacks initiative; tense; not aggressive; afraid.

6. Flying Cadet D.—Flying Cadet D, age 22. Original examination, June 9, 1926. Reexamination, November 9, 1926.

History.—*a. Family*.—The oldest child in a family of four—two sisters and one brother; all well. Father 58; mother 46; living and well.

b. Personal.—(1) No birth traumas. No serious diseases or injuries. No knowledge of time of learning to walk or talk. Preferred playing with boys. Easy to make friends. Up until the age of 10 he made little effort at defending himself, and was imposed upon a great deal. At about this time he was beaten up by another boy, and when he told his troubles at home he was threatened with another beating if he ever came home under the same conditions again. So he began defending himself, and had no further difficulty thereafter. He did not tease, and resented being teased, later he says he got over this. Has not the fighting instinct.

(2) *Somatic demands*.—He prefers physical activity. Is overtalkative; prefers talking to listening. He preferred books up until the age of 18, then he began going out, and since that time has preferred people. He likes social functions. It is easy to have a good time, likes to meet strangers, feels perfectly free with them. Smokes six or eight cigarettes daily. Practically no alcohol. No childhood habits prolonged into early boyhood. Masturbation began at 10, and continued up to the age of 18. This habit was hard to get rid of.

First performance was done by a boy friend. Began having dates at 13. He went with this girl 5 years. Says they were engaged to be married. Friendship was terminated by some delay in her mail. He thought that she had failed to write to him so he became angry, and wrote to her that if he did not hear in 2 weeks' time their engagement would be terminated. He did not receive the letter in the time allowed and so they drifted apart. Later, he found out that her mail was intercepted by some of his boy friends, opened, and later given to his wife. He felt this disappointment very keenly; he felt badly about not having the proper confidence in his girl friend. He met a girl at a dance 2 weeks after he had broken off his engagement, and after an acquaintance of 1 week they married. After they were married a short time his wife began going out with other men, staying away over week ends, etc. He put up with this for a time, but finally remonstrated with his wife about it; and she decided to go away with one of her boy friends. She was away 4 months. He at last prevailed upon her to come back, which she did. They lived together for a few months, and she was taken sick and died. When he met the girl whom he later married, he was teaching dancing at a dancing academy. He followed this line of work for a period of 1 or 2 years, and finally his wife became his dancing partner, and they were making very good money about the time of her death doing exhibition dancing.

(3) *Education*.—Grammar at 5, finished at 14; high at 14, went 1 year, dropped out. Joined the Marine Corps, fraudulent enlistment. While in the Marine Corps he received no promotion, although he was in the Marines for 3 years. After his discharge he worked for 5 months, and then went back to school for 3 months. Was then out for 1 or 2 years; then returned, and finally graduated at the age of 22. Reasons for irregularity in school attendance were financial difficulties. His easiest subject was mathematics; his most difficult was geometry. Usually stood in upper third of his class.

(4) *School activities*.—Debating team, and a member of quartette.

(5) *Athletics*.—Basketball team in high school and swimming team.

(6) *Learning*.—Rate, mental, average; motor, slow; capacity, average; motor, below average; retention, average; attention, had difficulty in concentration on things in which he is not interested; not easy to shift from one thing to another.

(7) *Environment*.—Economic conditions were very satisfactory. Father was able to send him to college. His father entered him in school several different times with the promise of financial support,

but this support would usually be withdrawn. He and his father never did get along well.

(8) *Attitude of family*.—Mother approves.

(9) *Disciplinary record*.—Feels resentment of the treatment received from his father. Has some paranoid tendency. In Marine Corps service received a summary court martial for stealing a pair of shoes; was sentenced to a \$30.00 fine. Next he was charged with desertion of post, and sleeping on post while detailed to guard duty. For this he was tried by a general court and received a dishonorable discharge.

(10) *Temperament*.—Cheerful; unstable; pacific; frank; fond of people; frivolous; strong suspicion of sex perversion.

(11) *Intelligence*.—Is vague; superficial; exercises poor judgment.

(12) *Volition*.—Quick; fair tenacity of purpose.

c. Impression.—This cadet is exceptionally poor material. He may learn to fly, but if he should, he would be of no value.

d. This student was permitted to begin regular training with his class and continued training until he had accumulated 47 hours and 50 minutes flying time. At this time he was brought before the faculty board and eliminated as a result of "failure to make satisfactory progress in flying training." The following adverse comments were made by the various instructors on his flying technique: Poor judgment; reacts slowly; retention poor; cross controls; lacks coordination; erratic; no feel of ship.

7. *Flying Cadet E*.—Flying Cadet *E*, age 22. Original examination June, 1926. Reexamination October 29, 1926.

History.—*a. Family*.—Oldest child in a family of five; one brother and two sisters living and well. One brother died at birth. Father 50 years of age, living and well. Mother died at the age of 35 from Bright's Disease. At the birth of her last baby she had a rather serious time; was never well after that and continued to decline, dying about 8 months later.

b. Personal.—(1) No birth traumas. At the age of 7 received an injury to the frontal region of his head which knocked him unconscious for a short period of time (1 minute). No serious illnesses. He preferred playing with boys. It was easy to make friends, and he preferred those of his own age. He did not tease and was not resentful when teased. He had few fights, always on the defensive. He never allowed himself to get angry. Has been rather submissive, was always a follower. Exceedingly shy and bashful around girls.

(2) *Somatic demands*.—Has been rather fond of comfort indulgence. He is underactive physically and undertalkative, prefers

listening to talking. He preferred books to people up until 3 years ago; since that time he has made an effort to associate more with people, and now claims he prefers people. He bit his finger nails up until the age of 7. He uses no tobacco or alcohol. He does not give vent to his feelings, has practiced suppression of all emotions. At the death of his mother, to whom he was very much devoted, he was unable to cry. He became interested in girls at 16, and shortly thereafter began having dates, but he has been exceedingly shy around girls, never been fortunate in his love affairs. His disappointments he feels keenly. He is inclined to lead a fantastic existence. Most of his romances have been of this type. Has never been affectionate with mother, sisters, or girl friends. He began masturbation at 12, rather excessive over a period of 5 years. This he worried about a great deal, but claims now he has it under complete control. Has never had heterosexual contact. Sex discussions are repulsive to him. Has strong religious convictions, and from these he received great comfort. He feels out of place most of the time, and unable to adjust himself. He wonders if "going out and raising hell once in a while" would aid him in making better adjustments. He thinks people observe him unduly and discuss him when out of hearing.

(3) *Education*.—Began grammar school at 7, finished at 14; high school at 14, finished at 17. He got along well in school; says it was easy for him to learn and that he retains learned material well. His mechanical learning capacity was also fast. He desired to go to college but his father would not agree to it, and said he "should go to work." He has some talent for music, claims that he plays the violin fairly well.

(4) *Ambition*.—Did not have anything definite in view up until 1 year ago and then he decided to become an officer in the Army. He went to a recruiting office and was pumped full of lies, so he enlisted in the Air Corps. He did not like it as a soldier because "the other soldiers picked on him."

(5) *Athletics*.—Has been below the average in athletics, took some part in the games played in grammar school, no active part in high school. He never learned to dance but at present is taking dancing lessons, and feels that he is making fair progress.

(6) *Economic conditions*.—His father was from a very wealthy, influential Pittsburgh family. He was the youngest son; married against his people's wishes, and was disinherited. His mother was of the poorer class; had a high school education, and was a very high type woman. His father started a small business and was making

very good success. The home life was happy. About 15 years ago he fell heir or gained possession of his portion of the estate which amounted to about \$100,000.00. He immediately gave up his own little business and made a bold advance on Wall street where he very quickly lost all his money. After losing his money he seemed also to lose all ambition, and has never pretended to do anything toward earning a living since. His grandmother who is still living gives his father from month to month enough money to take care of his modest needs. His father is a dreamer. Has invented several things but has never realized anything from them. He has given little attention to his children. Although being highly educated himself and all his people are highly educated, he has shown no interest in the education of his own children and made no effort to send them to college. About 1 week following his mother's death his father proposed matrimony to his mother's sister.

(7) *Self-estimate*.—Is unfavorable.

(8) *Stigmata*.—Receding chin; narrow dental arches; asymmetry of ears.

(9) *Temperament*.—Tense; unstable; submissive; unable to make good adjustments; enthusiastic; good cooperation; serious; modest; frank; some ideas of reference; strong mother attachment; effeminate make-up.

(10) *Intelligence*.—Precise; sharp; alert; deliberate; lacking initiative.

(11) *Volition*.—Fairly energetic; restless and yielding.

c. Impression.—Introvert; unsublimated inferiority complex; not in good contact with reality; has a plastic learning capacity which should enable him to grasp readily the mechanics of flying, but there are other factors which are big liabilities, and it is not believed that he will successfully complete the training.

d. This student was permitted to begin regular training with his class and continued training until he had accumulated 73 hours and 10 minutes flying time. At this time he was brought before the faculty board and eliminated as a result of "failure to make satisfactory progress in flying training." The following adverse comments were made by the various instructors on his flying technique: Poor judgment; lacks decision; poor judge of distance; retention poor; lacks coordination; no control of plane; not aggressive; reacts slowly; no feel; no sense of speed; rough on controls; mechanical; indifferent; careless; apprehensive; afraid; tense; nervous; dangerous.

APPENDIX III
BIBLIOGRAPHY

Material from various texts, articles, monographs, and papers have been drawn upon freely and credit is due the following sources which have served as references and have been helpful in the preparation of this manual:

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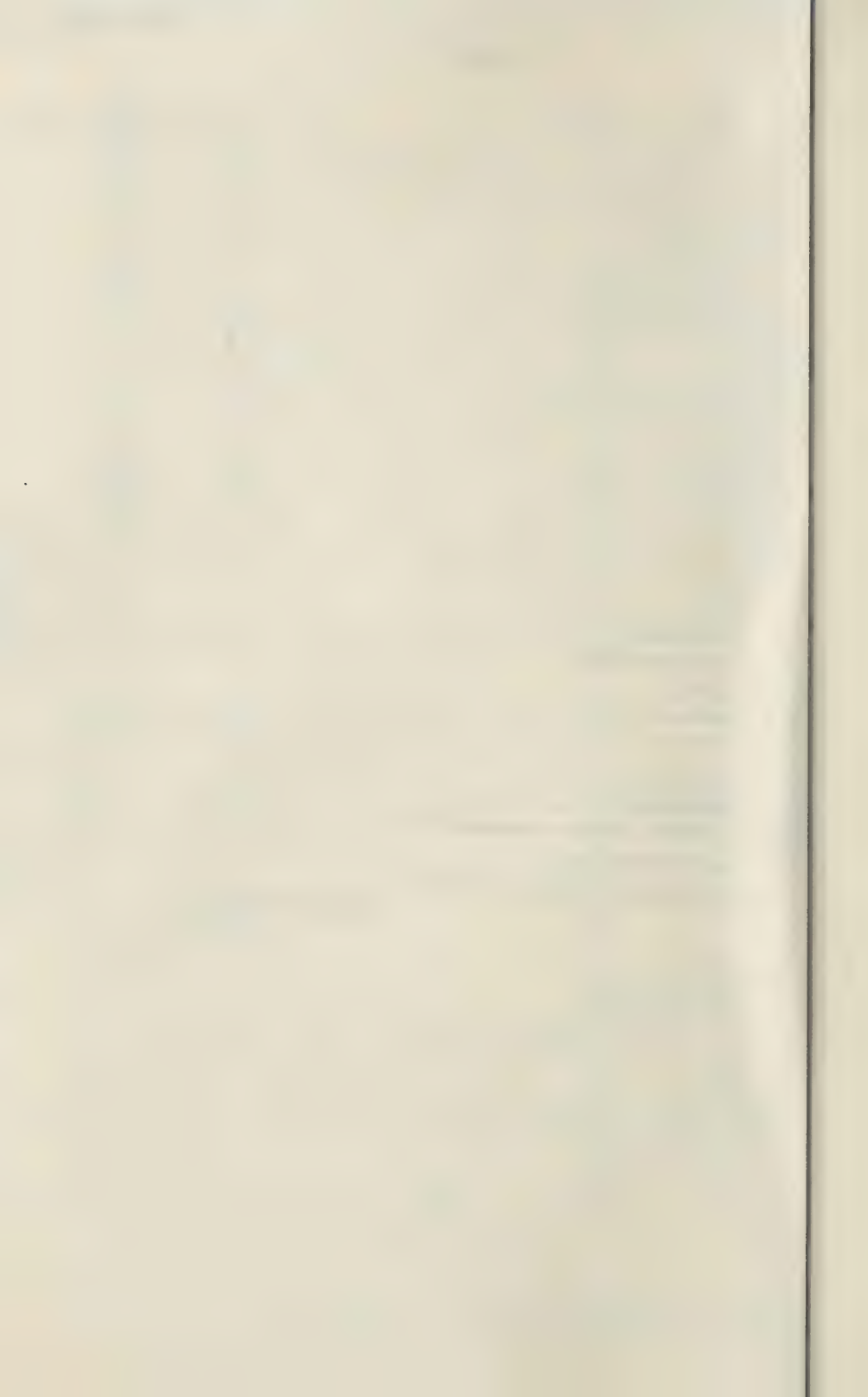
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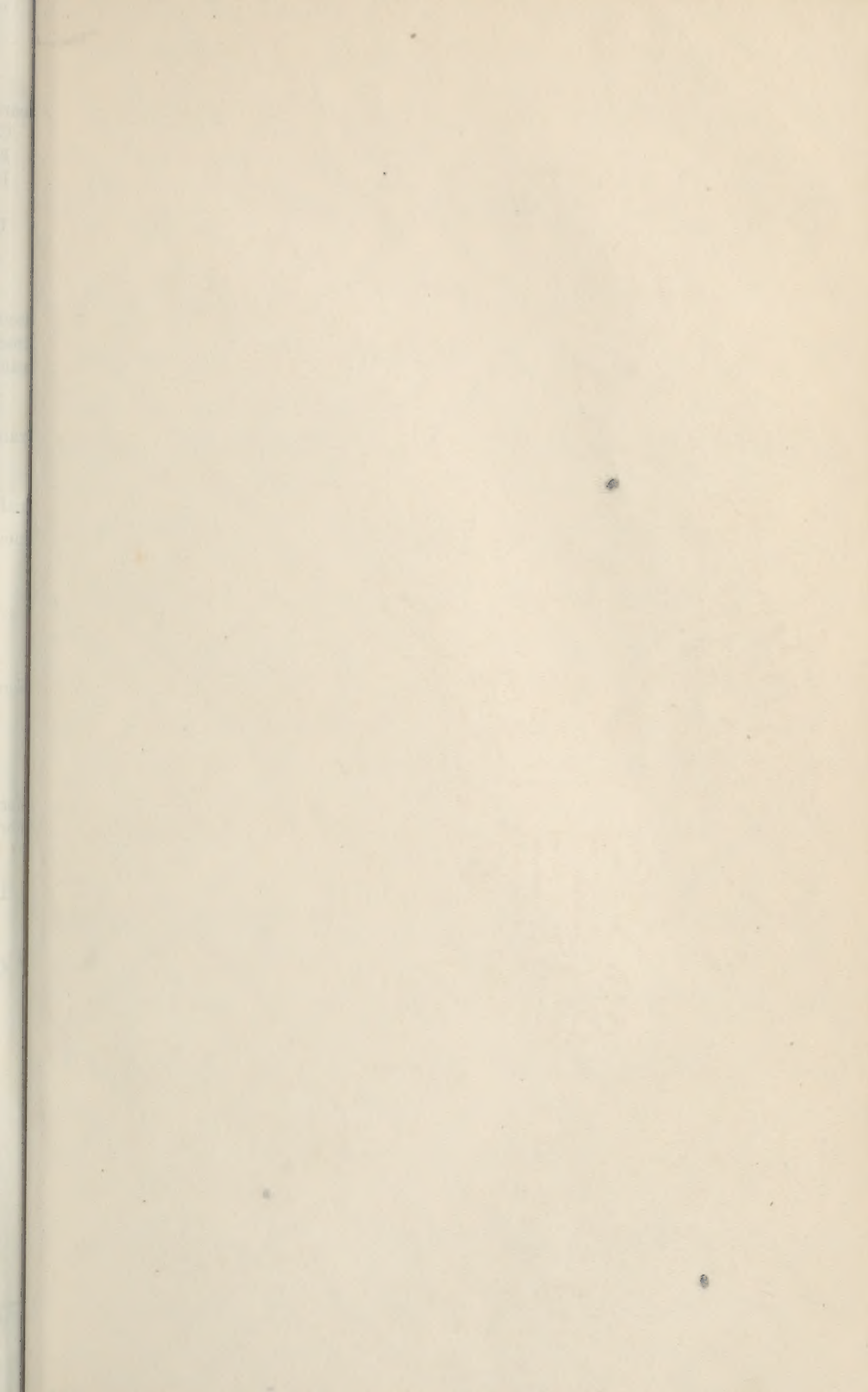
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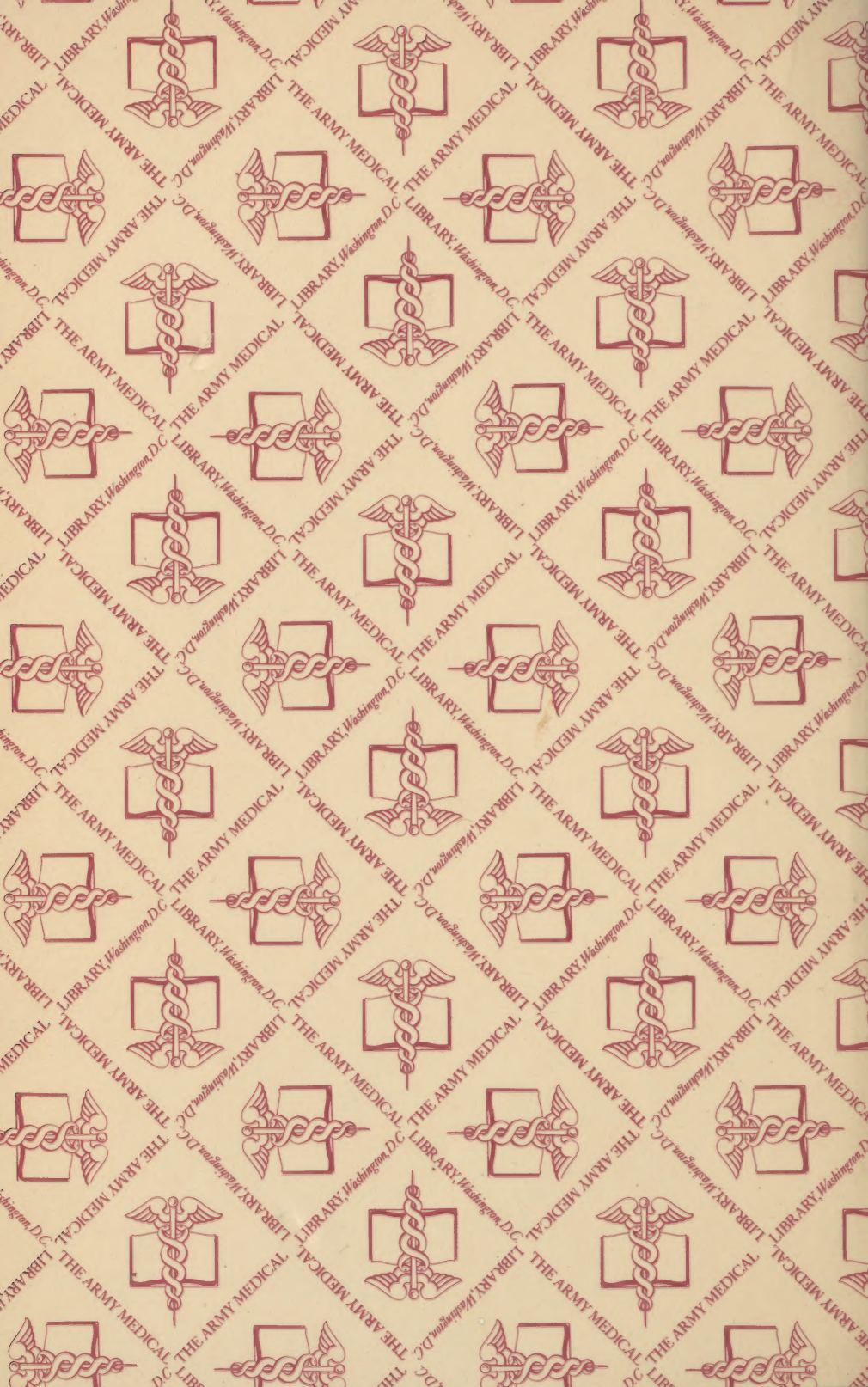
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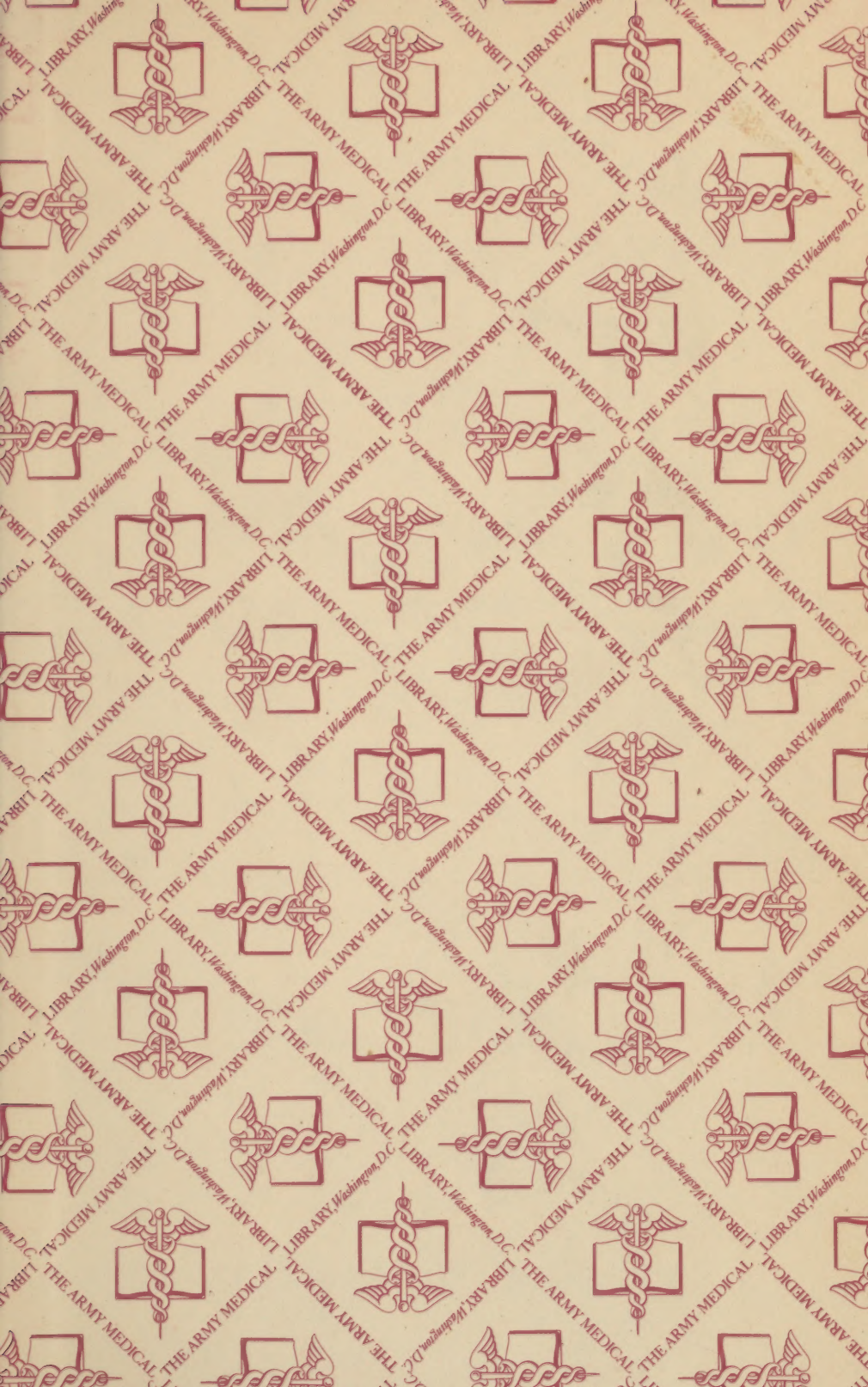
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